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Basic Water Monitoring Program

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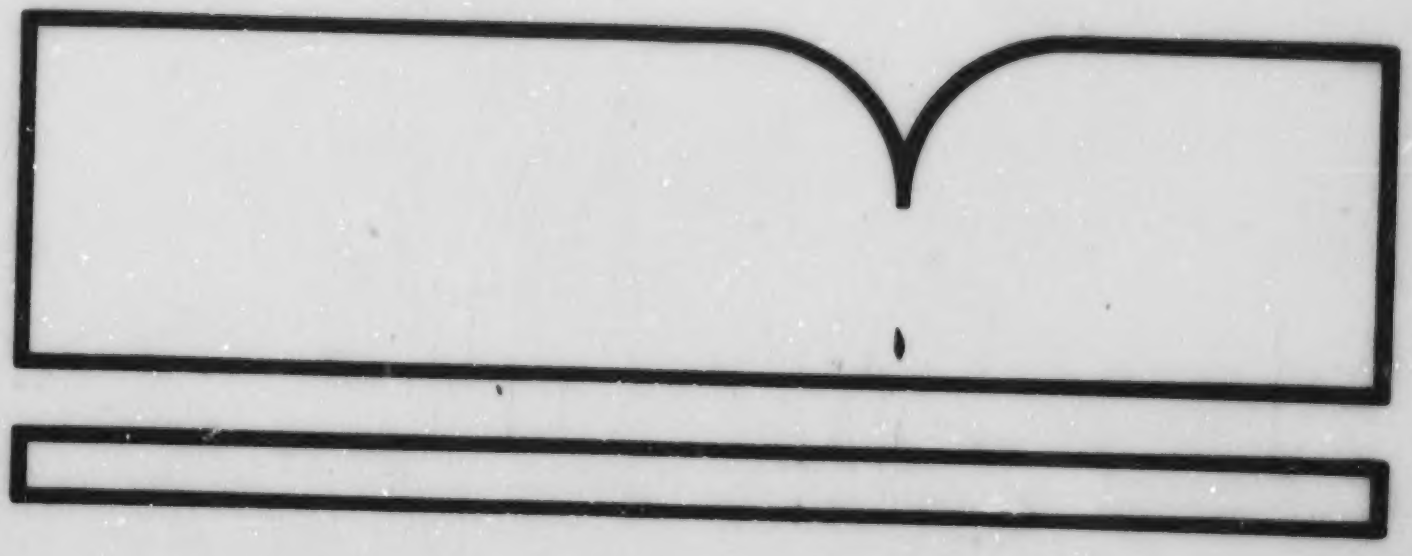

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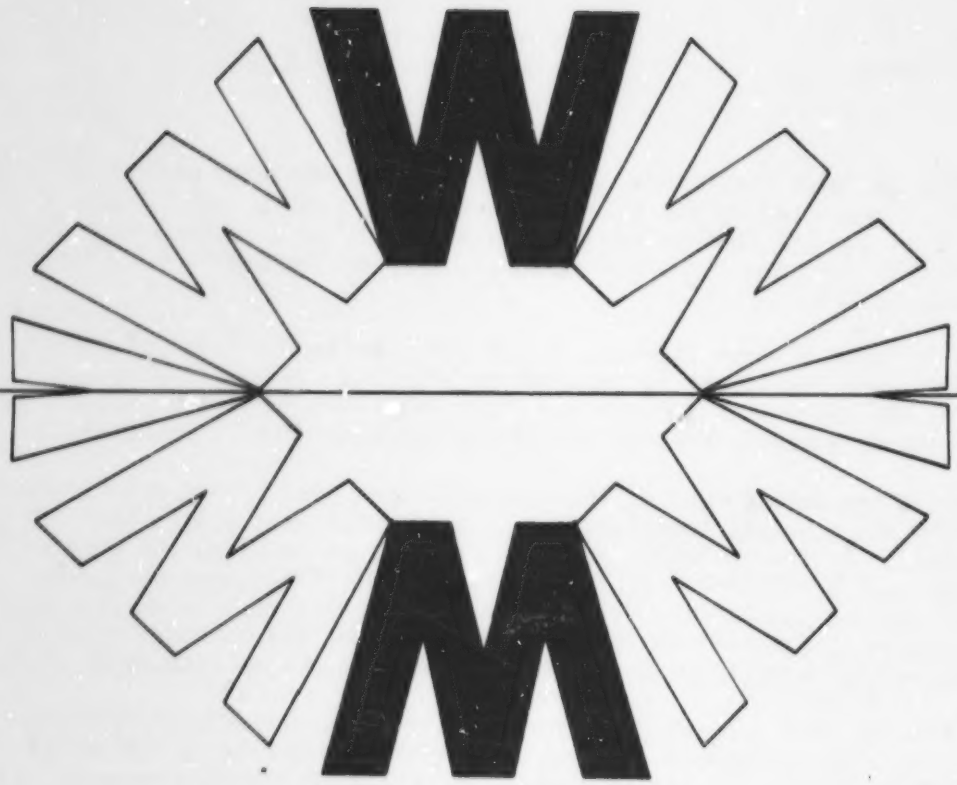
Basic Water Monitoring Program



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To the Reader:

This document recommends changes in the EPA and State water monitoring programs. Developed by the Standing Work Group on Water Monitoring, with the help of the EPA Regions and the States, it is an essential step in beginning to make the fundamental changes that are needed in our monitoring programs.

This basic program document is not a regulation or a set of strict quidelines and should not be implemented blindly. Instead, you should consider the program as a basic structure which, when realized, will contribute to a more effective use of our water monitoring resources.

While the development of this structure has been a long and difficult task, and has involved contributions from many talented people the real job lies ahead. As the pollution problems become more complex, our monitoring programs must become more sophisticated and cost-effective. We cannot control what we cannot measure and we cannot correct what we do not know. This program is intended to form the basis for our future water monitoring efforts by stabilizing the existing programs around some reasonable goals.

Finally, this program projects the need for a strong partnership among the States and the Regions. I urge each State and Region to foster this cooperation through the implementation and operation of this program, and beyond. Your combined cooperation is vital to the success of the monitoring programs and, ultimately, to the pollution abatement programs as well.

John Quarles

John R. Quarles, Jr.
Deputy Administrator

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The Basic Water Monitoring Program was developed to bring structure and order to State Monitoring Programs in response to Public Law 92-500.

1. The program is designed to redirect State monitoring from fixed-station single discharge to an intensive survey approach.
2. Identify dischargers and assess their water quality impact.
3. Define number and type of stations operated by States.
4. Provide a coordinated nationwide assessment of selected toxic pollutants.
5. Ensure that data collected are used in decision-making process and to educate the public and inform the Congress.

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Basic Water Monitoring Program

Developed by the
Standing Work Group on
Water Monitoring

May 2, 1978: This document contains revisions on Pages 13, 25, and 26 and thereby supercedes the original document issued in 1977. The STORET parameter codes in Tables 4 and 5, Pages 25 and 26, respectively were originally in error and now stand corrected. A reference to Chapter 6 on Page 13 was inadvertently excluded in the original. It is now included.

Foreword

This "Basic State Water Monitoring Program" has been developed in response to an expressed need to bring some structure and order to the many State monitoring programs. Most of the State monitoring program designs and rationales were seriously disrupted by the passage of Public Law 92-500. It is safe to say that the provisions of PL 92-500 are much different than those of the previous legislation and, therefore, the monitoring required to support the "Act" is much different.

The need for routine surveillance of water quality standards violations at a large number of monitoring stations in each State has been replaced by the need for routine inspection of major and minor dischargers for NPDES permit violations. The setting of NPDES permit conditions is done either by the use of uniform effluent guidelines for each industry or by direct and rigorous cause-and-effect water quality analysis in those areas where effluent guidelines are not sufficiently restrictive. The monitoring required to support permit issuance or revision is, therefore, primarily in the form of intensive stream surveys that directly tie water quality conditions to discharger conditions.

Similarly, the "Act" does not intend for Statewide assessments of water quality problems and conditions to be divorced from assessments of the major determinants of water quality problems: point and nonpoint sources of pollution. Again, each assessment is best made with the use of an intensive stream survey that ties dischargers to water quality conditions.

At the national level, the broad policy, legislative and budgetary issues in water quality protection are most effectively addressed through a uniform network of fixed monitoring stations used in conjunction with the State reports to Congress required by Section 305(b) of the "Act". These issues are generally unpredictable in terms of scope or required response time and the impacts of their resolution on national and State water pollution control programs is large. As a result, each State must be concerned with how well EPA can analyze and explain water quality issues and conditions in the national aggregate.

The Standing Work Group on Water Monitoring, with the active cooperation of the EPA Regions and the States, has attempted to forge a consensus on what a basic State program under PL 92-500 should be. In so doing, a partnership has been formed between the States, the EPA Regions and the EPA headquarters Offices. The strength and endurance of that partnership through the implementation process will determine the success or failure of the EPA and State water monitoring programs' performance in the future.

Acknowledgment

The Standing Work Group on Water Monitoring would like to thank the Regional Offices and the many States that have contributed to the development of this document. Appreciation is also extended to the members of each Program Office within EPA headquarters for their assistance.

Preface

On December 24, 1975, EPA Deputy Administrator John R. Quarles established a Standing Work Group on Water Monitoring and a similar group for air monitoring. The Standing Work Group was charged with the task of reviewing ongoing monitoring activities and developing cost-effective water monitoring programs in the EPA Regions and the States.

The Standing Work Group on Water Monitoring is made up of representatives from the Office of Research and Development, the Office of Planning and Management, the Office of Enforcement, the Office of Water and Hazardous Materials, the Surveillance and Analysis Divisions (Region V), The Water Divisions (Region III), The State of Washington, the State of Texas, The State of Wisconsin, The State of Florida and The State of Maryland. A membership roster follows:

Robert L. Crim, *Chairman*
Office of Water and Hazardous Materials
U.S. Environmental Protection Agency
202/755-1567

David Lyons/Donald Olson
Office of Water Enforcement
U.S. Environmental Protection Agency
202/755-0994

Truman Price
Office of Planning and Management
U.S. Environmental Protection Agency
202/755-0350

Robert Booth
Office of Research and Development
U.S. Environmental Protection Agency
513/684-7301

Christopher Timm
Surveillance and Analysis Division, Region V
U.S. Environmental Protection Agency
215/353-2300

Fred Grant
Water Division, Region III
U.S. Environmental Protection Agency
215/597-9410

Tim Stuart
Department of Environmental Regulation
State of Florida
904/488-6221

Jerry McKersie
Department of Natural Resources
State of Wisconsin
608/266-2879

Linda B. Wyatt
Texas Water Quality Board
State of Texas
512/475-5695

Richard Cunningham
Department of Ecology
State of Washington
206/434-2845

Henry Silbermann
Department of Natural Resources
State of Maryland
301/269-3548

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Chapter 1.

Introduction

The totality of monitoring is categorized as follows:

- Monitoring which is needed by EPA to meet national requirements:
- Monitoring which is needed by EPA and the States to meet joint requirements. This monitoring must be uniform; and,
- Monitoring which is needed by the State to meet State requirements.

The first two categories will be addressed in this basic program. The third category, although not specifically addressed, is an essential part of a state monitoring program and should be a high priority in the total monitoring structure.

Background

The first task undertaken by the Work Group was to develop a broad perspective on monitoring activities, uses, problems and potential solutions at the Federal and State level (Appendix E). This was handled primarily through a series of interviews with headquarters' officials who are responsible for or involved in some way with the collection or use of monitoring data. A questionnaire was also provided each person prior to the interview. The information obtained from the interviews was supplemented with similar information provided by the EPA Regions and the States.

As a result of this effort, the Work Group determined that:

- Monitoring is not a single program but rather consists of several smaller programs that are not integrated;
- There is too much money being spent for too little total information;
- There is a deficiency of information in several areas, primarily regarding toxic substances; and,
- There is concern and confusion on the part of most States in understanding EPA monitoring priorities and direction.

Program Objectives

With this as background, the Standing Work Group established four primary objectives upon which the following basic program was developed:

- Develop a monitoring program that will stabilize State programs, clearly stating what is expected of EPA and the States;
- Develop a monitoring program that will improve the effectiveness of State and EPA programs and reduce duplication of effort;
- Develop a monitoring program that will ensure that fundamental data needs are met; and,
- Develop a monitoring program that makes the best use of existing resources and technology.

Program Description

The basic program is a "core" program which is designed to:

- Redirect ambient and effluent monitoring at the State level from a fixed-station, single discharge approach to an intensive survey approach;
- Identify dischargers to the States' waters and assess their water quality impact;
- Define a minimum number of fixed ambient stations that are to be operated at the State level, within a consistent framework;
- Provide a coordinated nationwide assessment of selected toxic pollutants; and,
- Ensure that data which are collected are *used* in the decision-making process and to educate the public and inform the Congress.

State conditions should be adapted to this "core" program through addition, rather than subtraction or substitution.

The basic features of the program* are as follows:

- Goals have been set for the operating level of intensive surveys done as part of the basic program. The goal is to conduct an intensive survey at least once within five years on every river, lake, estuary, bay or aquifer where waste loads are allocated or significant water quality changes have either been identified or are considered probable.

  The intent is for the State to use the intensive survey as the primary vehicle in determining whether water quality conditions are improving or getting worse. Interpretation of survey data is to be included in the Section 305(b) Report.

  Intensive surveys can be used to address specific issues such as cause-and-effect relationships and waste load allocations. Intensive surveys can also be used to explain the spatial significance of ambient station siting, to facilitate interpretation of the data collected at ambient stations, and as a mechanism for integrating monitoring components to improve resource management.
- Goals have been set for the operating level of ambient fixed stations selected as part of the basic program. Parameter coverage, sampling frequency and station siting criteria are specified for those fixed stations that will be operated as part of the minimum core program.

  The ambient stations will be operated by the State with the data to be aggregated nationally and will be used primarily to determine national trends in water use areas (water supply, fishing/shellfishing areas etc.), problem areas, land use areas (municipal/industrial, agricultural/rural), and in areas where future development may impact water quality and thus baseline trends are needed. These analyses are to be used in developing control and budget strategies, initiating legislation and supporting budget and grant requests at the national level.

  The ambient stations selected for the core program should be a subset of existing State and Federal networks.
- Goals have been set for the operating level of effluent monitoring programs. Major dischargers should be inspected annually with sampling as necessary to ensure compliance with applicable effluent limitations.

  Effluent information will be used to support enforcement actions, to measure the success of abatement activities and to supplement and explain ambient trend information. Particular emphasis will be to improve the quality of discharger-supplied monitoring data.
- This program should result in information supplied in a manner and in terms that should be readily understood by the Congress and the general public.

Each component is discussed in greater detail in its respective chapter.

*A basic biological monitoring pilot program is included in this document but is not a program requirement (see Chapter 6).

Program Implementation

The basic program document is intended to serve as monitoring guidelines under the Section 106 Appendix A regulations and will be implemented through the FY78 State and Regional program guidance.

During FY77 each Regional Administrator should join with his States in preparing a program implementation plan. The plan should include, in part, those fixed stations selected as part of the basic ambient "core" program, delegation of effluent monitoring responsibilities, and a five-year plan for intensive surveys.

Program operation is expected in FY78; full operation is expected by FY80, with selected exceptions.

Funding for the program is considered available as part of the existing Section 106 grant funds.

Roles and Responsibilities

This program recognizes the State responsibility for sample collection, laboratory analysis and data interpretation and reporting in cooperation with the Regions.

If a State has not developed the capability for complete laboratory analysis, the Regions will assume responsibility until such time as the

State has developed the necessary capability. After one full year of operation, the Region should return the responsibility back to the State. Under unusual circumstances, a one-year extension can be considered. The State also has the option of entering into a contractual arrangement to perform any of the required activities.

Responsibilities associated with National Pollutant Discharge Elimination System (NPDES) authority remain unchanged.

Continuing Program Review

While monitoring programs require stability, they must be flexible enough to maintain relevance to changing program objectives.

To maintain this consistency, the entire program will be revaluated on an annual basis cooperatively with the States. Needed adjustments will be a part of the annual State and Regional program guidance.

Future Issues

Several items must still be addressed by the Standing Work Group. These include:

- Biological monitoring;
- Integration and coordination of other monitoring programs;
- Monitoring for water supply; and
- Maximizing the use of NPDES self-monitoring data (DMRs).

The States are encouraged to provide input to these and any other issues to the EPA Regional Office and to the Chairman of the Standing Work Group on Water Monitoring.

The general process for resolving issues is as follows:

1. Identification of the issue;
2. Development of an EPA/State proposal;
3. Draft distribution, comments and discussion at meetings of the Standing Work Group on Water Monitoring;
4. Discussion at direct meetings with the States; and
5. Incorporation into the State/Regional Program Guidance.

Chapter 2.

Quality Assurance

All samples collected as part of the basic program must be collected, preserved, and analyzed according to approved methodology. Approved methodology is cited in the Section 304(g) regulations.

An active quality assurance program is required for operating an adequate water monitoring program. This is especially true in a program such as the NPDES Program in which EPA or an approved State relies heavily on self-monitoring data submitted by the permittee.

An adequate quality assurance program should include: Replicate samples done 5-10 percent of the time; spike samples done 5-10 percent of the time; reference samples done once a quarter; and, performance samples done once per year.

Also, to support the operation of a consistent quality assurance program, the following documents should be consulted:

1. Model State Water Monitoring Program, USEPA, June 1975, Chapter VI, (EPA-440/9-74-002).*
2. Minimal Requirements for a Water Quality Assurance Program, USEPA, 1976, Washington, D.C., (EPA-440/9-75-010).*
3. Program Grants, State and Local Assistance, Title 40, Chapter 1, Part 35, Appendix A, USEPA, Federal Register, Vol. 41, No. 82, Tuesday, April 27, 1976.
4. Handbook for Analytical Quality Control in Water and Wastewater Laboratories, USEPA, NERC Cincinnati, Ohio, June 1972.

*Available from the Office of Water Planning and Standards, Monitoring and Data Support Division (WH-553), U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C., 20460.

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Chapter 3.

Intensive Survey Program

Introduction

A program of intensive water quality investigations of high-priority streams, lakes, estuaries, bays, or aquifers should be conducted to address specific issues such as cause-effect relationships, waste load allocations and water quality standards assessment. These surveys should also be used to explain the spatial significance of ambient station siting and facilitate interpretation of data collected at ambient stations. But most importantly, intensive surveys should be used as a mechanism for integrating monitoring components to improve resource management (i.e., intensive surveys to support planning, permit revision, etc.).

These intensive surveys will assist the State and Areawide Water Quality Planning and Management Agencies in developing their water quality management plans under 40 CFR Parts 130/131. These planning agencies will need data necessary to define water quality problems, effluent surveys in combination with NPDES compliance monitoring data to define point source contribution and periodic surveys to assess non-point source contribution.

Intensive surveys will also assist State and Areawide Water Quality Planning and Management Agencies in developing wasteload allocations and in setting water quality standards. Specifically, data from such surveys will be used in the validation of segment classifications and in the calibration and verification of mathematical models.

Water monitoring for State and areawide water quality planning and management will usually be conducted by the State or the areawide agency (usually through contracts), and can be funded for up to two years by a Section 208 grant. The intensive surveys conducted through this Basic Program should provide, in many cases, much of the required data. Careful coordination should therefore exist between State Sections 106 and 208 undertakings.

Intensive surveys will vary widely in scope depending on the nature of the water body or aquifer and problem(s) under investigation. Some investigations may involve a one-time survey of a lake or river to document point-source-related problems or improvements at a critical season of the year. At the other extreme, studies to relate land-use practices or non-point sources to water quality may require several intensive surveys of the same body of water or aquifer at various times during a given year.

The goal is to conduct an intensive survey at least once within five years on every river, lake, estuary, bay or aquifer where waste loads are allocated or significant water quality changes have either been identified or are considered probable. Specific water regions to be considered for intensive study are to be selected annually by the State in cooperation with the EPA Region through annual revisions to the five year plan for intensive surveys.

Scope of Investigations

It is not feasible or desirable to specify the details of the proposed investigations. Sampling frequency, station locations, study duration, and parametric coverage will be determined by the specific objectives of the investigations. There are some features, however, which should be common to all intensive investigations. These include:

1. The data obtained should improve interpretation of the data from existing ambient stations, and should explain the spatial significance of ambient station siting. This may require concurrent sampling of an ambient station with other survey stations, conducting time of travel or dilution studies, etc. A result of the studies

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may be recommendations for adjusting the siting of ambient stations, or establishing additional ambient stations. To the extent that laboratory and field resource constraints permit, the parameters measured during the intensive investigations should, at a minimum, be the same as those for the ambient stations (at least for selected stations and sampling periods).

2. Where mathematical models are to be operated, the design of these intensive surveys should include location and number of stations, parameter coverage, and the sampling frequency necessary to support development, calibration and verification of the models.
3. The intensive investigations should account for the effects of all significant point sources impacting the study area. This will generally involve roughly concurrent effluent sampling and receiving water monitoring. Clearly defining the loads and resulting impacts is very important in developing cause-effect relationships, providing input to modeling efforts, and in establishing the relative effects of point and non-point source pollution. The effluent sampling should result in a compliance determination for the source(s) and should include any known or expected problem contaminants, toxic substances, etc., which may not be covered by the dischargers' NPDES permit.
4. If toxic substances are discharged within the basin under study, the intensive survey should include some assessment of the distribution and accumulation of these toxic substances. In addition to the sampling necessary to define the effects of known toxicant discharges, the surveys should include selected samples of sediment and appropriate biota to allow a screening for toxic substances.
5. The studies should begin with available data, including DMR data, and resources of other State and Federal agencies. Many of these agencies are responsible for activities which directly or indirectly impact water quality. Moreover, many of them have sponsored or conducted studies which may provide input to the design of the intensive investigations in question. Quite often, a rigorous analysis of existing data from these agencies will answer many of the questions facing environmental agencies and may reduce the scope or occasionally eliminate a proposed intensive investigation. If a survey is needed, the appropriate agencies should be consulted in planning and conducting the study. Many of these agencies are developing or expanding their environmental studies and monitoring programs and are looking for guidance in water quality monitoring. Participation in intensive investigations will provide needed training for other agency personnel and will establish or improve working relationships. Frequently, these agencies may establish longer-term studies or monitoring programs to follow up on problems identified by the intensive investigations.
6. The studies should include an assessment of attainment or non-attainment of the 1983 "fishable-swimmable" water quality goal. The assessment may involve actual field data or may be based on an analysis of data from fishery agencies, county health departments, and other local agencies. Water quality standards should be highlighted in the assessment.

Intensive Survey Abstract

For each intensive survey conducted, the State should prepare a very brief abstract (two-to-three pages) describing the survey area and briefly summarizing the results of the survey. These abstracts should be forwarded to the EPA Region upon completion of the survey.

The interpretation of intensive survey data should be the basis for the Section 305(b) Report.

Chapter 4.

Ambient Monitoring Program

Introduction

Since the ambient monitoring program must maintain a uniformity among the States so that the data can be aggregated nationally, much more detail is necessary for this section than is required for the other sections.

Uniformity is essential to the effective operation of the ambient monitoring program. If the parameter coverage for a particular station(s) is altered, that State will have little or no impact on analyses or decisions made at the national level. Also if a parameter is dropped because it is "not a problem", the national analyses will emphasize water quality problems and any decisions based on these analyses will therefore be biased. So that a consistent format is maintained throughout the document, detailed specifications for the ambient monitoring program are presented separately as Appendix B.

The following ambient monitoring program is designed to measure progress toward achieving water quality goals at the national level. This is a basic ambient monitoring program. The intent is to redirect, to the extent possible, a portion of the State's monitoring program to address national needs without hindering State response to State and local needs.

The ambient monitoring program seeks to provide information necessary to answer the following questions:

- Are water quality conditions at the national level improving or getting worse?
  This broad question has two essential components:

  1. Are potentially toxic constituents that may seriously affect the health of the ecosystem and impair the safe consumption of fish and shellfish being accumulated within the food chain? Fish and shellfish are specifically referenced because: (1) These organisms are used directly by man as foodstuffs; and (2) since fish are situated near the top of the trophic chain, they reflect disturbances within the chain.
     We are concerned not only with the health of these aquatic species but also with human health following their consumption.
  2. Is the quality of the Nation's waters generally suitable for their intended water uses?
     Primary emphasis is placed on compliance with approved water quality standards.

- What is the extent of compliance with water quality standards nationally and what is required to insure that the compliance levels improve or remain high?
  This involves long-term analysis of water quality trends and an assessment of program plans, standards, pollution control programs and strategies at the national level.

The following monitoring activities are necessary in order to begin to define quality trends and conditions.

- Collecting, analyzing, and interpreting water samples for chemical, physical and bacteriological information to define water quality trends and to determine compliance with water quality standards.
- Collecting, analyzing, and interpreting fish and shellfish tissue samples for bioaccumulation information.

Program Description

The following describes the basic ambient monitoring program for rivers and streams, lakes and impoundments, and estuaries and bays.

The goal of the basic ambient monitoring program is to set up a national network of not less

than 1,000 stations comprised primarily of a minimum "core" network of State stations selected as a subset of ongoing State programs. The intent of this program is not to develop a new network of stations but to make portions of existing State networks uniform. Based on the monitoring specifications presented in Appendix B, the Regions and States should coordinate in developing a list of stations for each State for inclusion in the basic ambient program network. At each designated station, parameter coverage and sampling frequency must comply with the monitoring specifications described in Appendix B. These stations will then be aggregated on a national level to be used for national assessments and analyses as required by Congress or budgetary agencies.

This core network of ambient stations is not intended to satisfy State or local needs. State and local needs should be addressed by building upon the core network or preferably by using intensive survey data.

The NATIONAL AMBIENT MONITORING STATION DESCRIPTION FORM (Appendix A) must be completed by each State for each designated station. This form should also be used to describe special station characteristics such as parametric fluctuations or other unique environmental factors. A State map depicting station locations is also required.

In selecting these stations, the Regions and States should familiarize themselves with the other monitoring activities performed within their jurisdiction. The States and Regions are strongly encouraged to coordinate with these other monitoring activities, wherever possible.

Of particular note are the monitoring programs and cooperative monitoring programs of the U.S. Geological Survey (USGS) and the U.S. Fish and Wildlife Service.

Chapter 5.

Effluent Monitoring Program

Introduction

To achieve the goals established by the Federal Water Pollution Control Act Amendments of 1972 (PL 92-500), Section 402 of the Act authorized the creation of the NPDES program to issue permits for discharges into navigable waters. Permits issued pursuant to Section 402 of the Act contain specific and legally enforceable effluent limitations and self-monitoring requirements. The NPDES permit is the principal regulatory tool for reducing the quantity of pollutants discharged to the Nation's waters and for obtaining data on point source discharges.

Monitoring, recording and reporting requirements for any State or interstate agency participating in the NPDES program are contained in 40 CFR 124 Subpart G and 40 CFR 125.27. Requirements for inspection and surveillance support for the NPDES program are contained in 40 CFR Part 124.92.

Generally, compliance monitoring data collected as part of the NPDES program are used in compliance evaluation and in support of enforcement. However, compliance monitoring is also an essential element of a complete water monitoring program. The term "compliance monitoring" as defined in Subpart C(5) of Appendix A of 40 CFR 35.559(b) (1), means measuring and analyzing pollutant sources, reviewing reports and information obtained from dischargers, and all other activities conducted by the State or EPA to verify compliance with effluent limits and compliance schedules. As thus defined, compliance monitoring is composed of two sub-elements:

- **Compliance Review**

  The review of all written material relating to the status of a permittee's compliance with an NPDES permit including Compliance Schedule Reports, Discharge Monitoring Reports, Compliance Inspection Reports, etc.

  If a State does not have NPDES authority, compliance review is the responsibility of the USEPA for all permittees in that State. In a State that has been delegated NPDES authority, EPA retains compliance review responsibility for the State compliance program.

- **Compliance Inspection**

  All field-related activities conducted to determine the status of compliance with permit requirements, including compliance evaluation inspections (non-sampling), sampling inspections, production facility inspections and remote sensing (aerial photographs). All compliance inspections are to be conducted on the premise that these activities may lead to enforcement action.

The primary purpose of the compliance monitoring program is the verification of compliance with effluent limitations and compliance schedules. The information derived from this program can also be applied to the interpretation of national water quality trend data and can be used along with other information as useful inputs to other planning and water quality control programs. Self-monitoring (DMR) data, which presently amount to over 130,000 reports annually for major permittees, should be better utilized in the various water quality planning and management activities. It is necessary to stress the importance of all aspects of permittee quality assurance during compliance evaluation and sampling inspections so that the quality of the DMR data is maintained and/or upgraded.

Basic Effluent Monitoring Program Specifications

The goals of the basic effluent monitoring program are the following:

- Sampling inspections annually at all major permittees that have completed and placed on line facilities to meet statutory permit requirements.
- Compliance evaluation inspections annually of major permittees that have either not completed construction of facilities to meet statutory requirements or have previously demonstrated the ability to meet statutory requirements.
- Examination of permittees' quality control procedures during Federal/State inspection to ensure the reliability of self-monitoring data.
- Coordination, whenever practicable, of sampling inspections as part of intensive surveys to avoid sampling duplication and to maximize the usefulness of data obtained from these activities.

These goals are intended to be achieved by the joint efforts of the States and the USEPA Regional Offices. The distribution of work will be negotiated through the Section 106 process.

Compliance inspection activities may include either a compliance evaluation inspection (non-sampling) or a sampling inspection. A compliance evaluation inspection is undertaken for one or more of the following purposes:

1. Observe the status of construction required by the permit;
2. Assess adequacy of the permittee's self-monitoring and reporting program;
3. Check the completeness and accuracy of permittee's performance/compliance records;
4. Evaluate the permittee's operation and maintenance activities; and,
5. Ensure that permit requirements are being met.

For more detailed guidance on procedures for conducting a compliance evaluation inspection see the NPDES Compliance Evaluation Inspection Manual.*

A sampling inspection should satisfy all of the above purposes. It may be appropriate in the case of some industries to sample or inspect production processes. In municipal permits with percent removal effluent limits and some industrial inspections it will be necessary to sample the plant's influent and the effluent.

Sample Collection and Handling

Procedures must be instituted for ensuring sample integrity during collection, transportation, storage, and analysis. These procedures must protect against misidentification, loss or error of data relating to sampling, and theft, loss, damage, or alteration of the sample. In those cases where samples are being collected for evidence, the integrity of the sample must be guarded and thoroughly documented through chain-of-custody procedures. A chain-of-custody procedure is described in Part VI, Quality Assurance, Model State Water Monitoring Program (EPA-440/9-74-002).

*NPDES Compliance Evaluation Inspection Manual, USEPA Office of Enforcement, Office of Water Enforcement, July 1976.

Chapter 6.

Proposed Biological Monitoring Program (Pilot Program)

This chapter was prepared, in part, by EPA Regional Biologists.

NOTE

This Section is included as a pilot test. It is not a requirement of the Basic Water Monitoring Program at this time. All States should review this section of the program and are encouraged to implement this proposed program on a trial basis. All suggested changes and test results should be forwarded to the Chairman, Standing Work Group on Water Monitoring. This section will not be formally included in the Basic Water Monitoring Program without a thorough review by the States.

Introduction

The protection and continued propagation of aquatic life is vital to human health and welfare because of the importance of aquatic organisms as sources of human food, and their role in replenishing the earth's atmospheric oxygen supply and supporting recreational and aesthetic uses of water resources. This was recognized in the "Declaration of Goals and Policy," Section 101(a) of Public Law 92-500, which stresses the need to restore and maintain the biological integrity of the Nation's waters and to achieve a water quality which provides for the protection and propagation of aquatic life. Aquatic organisms are very efficient pollution monitors because they integrate the effects of water quality over long periods of time, and show the ill effects of spills or chronic discharges of toxic substances, brief sags in dissolved oxygen concentrations, and other short-lived episodes that could otherwise be detected only by maintaining continuous chemical monitoring programs.

Biomonitoring is defined in Section 502(15) as "The determination of the effects on aquatic life, including the accumulation of pollutants in tissues, in receiving waters due to the discharge of pollutants (A) by techniques and procedures, including sampling of organisms representative of appropriate levels of the food chain appropriate to the volume and the physical, chemical and biological characteristics of the effluent, and (B) at appropriate frequencies and locations.

The basic minimal ambient biomonitoring program described in this document is designed with these specifications in mind.

The objective of this proposed program is to begin to define the relationship between chemical/physical monitoring at selected points and biological monitoring in the areas surrounding those points. This will lead to a better definition of the water quality impact of pollutant discharges.

Definitions

Plankton—Small plants and animals, mostly microscopic, that either have relatively small powers of locomotion or drift in the water, subject to the action of waves and current. The plankton include free-living bacteria, algae, protozoa, rotifers and other small forms.

Periphyton—An association of microscopic plants and animals that live on or are attached to the stems and leaves of submerged aquatic plants, boat hulls, pilings, rocks, bottom ooze, and other submerged surfaces. The periphyton include filamentous bacteria and algae, protozoa, and other small forms.

Macroinvertebrates—Invertebrates that (are large enough to be seen by the unaided eye and) are retained by a US Standard No. 30 sieve, and live at least a part of their life cycles within or upon the bottom of water bodies. The macroinvertebrates include worms, insect larvae, snails, clams, crayfish, etc.

Biomass—The weight of organisms in a specified unit of the environment; for example, the weight of macroinvertebrates per square meter of stream bottom, or the weight of the plankton in a cubic meter of water, usually expressed as wet weight, dry weight or ash-free weight.

Chlorophyll—A green pigment in plants which captures light energy for conversion to chemical energy necessary to synthesize carbohydrates from carbon dioxide and water—a process termed photosynthesis.

Ecosystem—Includes the biological communities and nonliving environment.

Eutrophic waters—Contain an abundant supply of dissolved nutrients; may support a large biomass, such as algal blooms.

Species (singular)—A type of organism forming a natural population; or (plural) several types of organisms, forming a group of populations. Organism diversity refers to the numbers of species present in a community and the relative abundance (numbers or weight) of each species.

Program Description

The proposed basic biological monitoring program for rivers and streams, lakes and impoundments, and estuaries and bays is described in the following discussion.

STATION SELECTION

Wherever possible, biological stations should be located so that the data collected can be correlated with the chemical/physical data collected as part of the basic ambient monitoring program. A biological monitoring station will often encompass broad areas, rather than points, within a reach of river or in a lake or estuary. This is necessitated by the variety of habitats typically present in the body of water being monitored. Unless there is a specific need to evaluate the effects of a physical structure in the water, it is advisable to avoid areas which have been altered by structures such as bridges, weirs, or within discharge plumes, etc. As a result of these requirements, biological sampling stations may not always coincide with chemical or sediment sampling stations. The NATIONAL AMBIENT MONITORING STATION DESCRIPTION FORM (Appendix A) must be completed for each designated biological station. This form should also be used to describe special station characteristics such as parametric fluctuations or other unique environmental factors. A State map depicting station locations is also required. In selecting stations, the Regions and States should again familiarize themselves with all monitoring activities performed within their jurisdiction. Whenever possible, all are strongly encouraged to coordinate with these other monitoring activities.

When selecting stations, emphasis should not be placed solely on problem areas. If this program is to depict a national assessment, it must also include relatively clean water areas. Wherever possible, stations should be located at sites where historical data are available for correlation purposes. Specific station siting criteria should conform with those described as part of the ambient monitoring program in Chapter 4.

PARAMETER COVERAGE AND SAMPLING FREQUENCY

The principal communities of aquatic organisms are the plankton, periphyton, macrophyton, macroinvertebrates and fish. The algae in the plankton and periphyton, and the macrophyton (larger aquatic plants) are the food producing (producers) communities and the animal plankton and periphyton, macroinvertebrates, and fish are the food consuming (consumers) communities. Properties which are useful in determining the condition of aquatic communities include: (1) abundance (count and biomass), (2) species composition and diversity, and (3) metabolic activity. The basic biological monitoring program described below is designed to provide information on (1) the trophic status of lakes, reservoirs, and estuaries, through the use of plankton chlorophyll as an algal biomass (productivity) index, (2) the biomass (productivity) and taxonomic composition of the periphyton, which is a lower-food-chain-level producer community, (3) the abundance and species composition of the macroinvertebrates, which form an intermediate-food-chain-level consumer community, and (4) accumulation of toxic substances in fish and shellfish, which are upper-food-chain-level organisms.

The parameter list, sampling season, frequency and method for each hydrologic area are listed in Table 1. In order to promote consistency within the program, which is a necessity when developing reliable water quality trends, Table 1 must be applied to each biological station, i.e., no substitutions may be made to this list. Table 1 will be reviewed annually. At that time, amendments may be made based upon proper justification. The rationale for measuring each of these parameters is discussed below.

Plankton

Chlorophyll a—Since all algae contain 1-2% chlorophyll *a* on a dry-weight organic-matter basis, measurements of this pigment will give some indication of the algal biomass and, therefore, the amount of nutrients present in the water body. In lakes and estuaries, chlorophyll *a* will increase as the concentration of nutrients in the lakes increases. Thus chlorophyll *a* measurements can provide information on the current status and rates of eutrophication. Because of the natural seasonal and temporal variations in plankton populations, it is necessary to sample this community several times at monthly intervals.

Periphyton

Biomass (ash-free weight)—Natural periphyton communities are made up of many types of organisms (chlorophyll-bearing and non-chlorophyll-bearing). To quantitatively measure the relative size (abundance or biomass) of the periphyton community, a dried sample is heated to 500 degrees C. for an hour to burn off the organic matter. Simple subtraction of the ash weight from the dry weight will provide the amount of organic material (periphyton community) in the sample, commonly called ash-free weight. The biomass will be reduced in the presence of toxic substances.

Chlorophyll a—The chlorophyll content of the periphyton is used to estimate the algal biomass and as an indicator of the nutrient content (or trophic status) of the waterbody.

*Autotrophic Index**—The biomass (ash-free weight) and chlorophyll *a* measurements can be used in combination to determine the extent of degradable organic pollution. Periphyton communities in clean water are dominated by the algae, and have a biomass to chl *a* ratio of 50-100. However, if the waterbody is heavily polluted with degradable organic waste, non-chlorophyll bearing, consumer organisms (e.g. bacteria, slimes) will crowd out or overgrow the algae, and the biomass-chlorophyll *a* ratio for the community will increase. Values for this ratio (called the autotrophic index) greater than 100 will indicate organic pollution.

$$\text{*Autotrophic Index} = \frac{\text{Ash-free wt (mg/m2)}}{\text{Chlorophyll } a \text{ (mg/m2)}}$$

Macroinvertebrates

Species Identification—The presence or, perhaps most importantly, the absence of

TABLE 1
PARAMETER LIST AND SAMPLING FREQUENCY FOR THE PROPOSED BASIC BIOLOGICAL MONITORING PROGRAM

	Community of Aquatic Organisms			
Parameters	*Plankton*	*Periphyton*	*Macroinvertebrates*	*Fish/Shellfish*
Counts			X	
Species identification			X	X
Biomass (ash-free wgt.)		X		
Chlorophyll *a*	X	X		
Toxic substances				X*
Habitat Types				
Rivers		X	X	X
Lakes	X	X	X	X
Estuaries	X			X
Sampling Methods				
Sampling season	6/15-9/15	6/15-9/15	6/15-9/15	6/15-9/15
Sampling frequency	monthly	once annually	once annually	once annually
Sampling method	grab	glass slides floating sampler	Hester-Dendy Multiplate	
No. replicate samples	3	3	3	

*Fish tissue analysis is a specific requirement of the basic ambient monitoring program. See Chapter 4.

specific organisms from an area will give a good indication of the water quality. For example, several insect larvae (stoneflies, mayflies, and caddisflies) are largely clean water organisms and their presence and relative abundance usually indicate good water quality. Sludgeworms and blood-worms, on the other hand, can tolerate very heavy pollution levels. Their presence and abundance usually indicates poor water quality and/or undesirable changes in the physical and chemical nature of the substrate.

Counts—The total number of organisms and the number of individuals in each species within the macroinvertebrate community will serve as a good indicator of the productivity of the water and also water quality.

Species Diversity—The relative abundance of the species can be used to calculate a species diversity index which is sensitive to changes in the quality of the aquatic environment. In clean water areas, species diversity is normally significantly higher than in polluted areas. In the absence of pollution, the numbers of organisms in each species are more evenly balanced and are held in check by competition for food, predator-prey relationships, etc. If organic pollution is introduced, intolerant species will disappear or are greatly reduced in number, and tolerant species will increase in abundance due tc a decrease in competition. The result will be a decrease in species diversity, indicating a decline in water quality.

Fish and Shellfish

Shellfish—Shellfish, such as mussels, are long-lived, bottom-dwelling filter-feeders that accumulate toxic metals, pesticides and other hazardous substances from the surrounding water even when these pollutants are present in concentrations far below the levels detectable by chemical analysis of grab water samples. Collection and analysis of these organisms once annually, especially if taken during periods of low flow, will provide useful information on long-term trends in the presence of toxic substances in surface waters.

Fin-fish—Samples should include predators and bottom feeders. Predator fish represent the highest trophic level in the aquatic ecosystem and are likely to have the highest biomagnification of toxicants which are passed up through the food chain. The level of toxicants in the bottom-feeding fish will reflect the concentration of pollutants in the sediments.

Major discussion of toxic substances in tissues is contained in Chapter 4.

Cost

It is estimated that this proposed biological program will result in an incremental cost of $350-400/station/year over the cost per national ambient monitoring program station.

References

1. Weber, C. I. ed., 1973, Biological Field and Laboratory Methods for Measuring the Quality of Surface Waters and Effluents, U.S. Environmental Protection Agency, Cincinnati, Ohio.
2. U.S. Environmental Protection Agency, 1975 Model State Water Monitoring Program, U.S. Environmental Protection Agency, Washington, D.C., 20460.
3. Mackenthun, K. M. 1973, Toward a Cleaner Aquatic Environment, U.S. Environmental Protection Agency, Washington, D.C.
4. Weber, C. I. 1973, Recent Development in the Measurement of the Response of Plankton and Periphyton to Changes in Their Environment, In: Bioassay Techniques and Environmental Chemistry, G. Glass, ed., Ann Arbor Science Publishers, Inc., Ann Arbor, pp. 119-138.

Chapter 7.
Data Interpretation and Reporting

Introduction

One of EPA's and the States' major concerns is describing water quality to the Congress and the general public in terms which are easily understood.

EPA and the States must, therefore, be able to supply information on water quality trends and conditions, bioaccumulation of toxic constituents, and discharges to receiving waters in a manner that relates water quality data to factors that directly affect the public welfare.

Using the Section 305(b) reporting process, the States are responsible for reporting information on the quality of their waters, including current water quality relative to the 1983 goals, projected water quality following implementation of point source controls, a description of the nature and extent of nonpoint source problems and an assessment of the economic and social costs and benefits of achieving the goals of the Act. Data presentation should be according to the Section 305(b) reporting format outlined in Appendix C.

The Section 305(b) reports will be summarized and these summaries will then be used along with the national ambient data analysis to describe water quality on a national level to the Congress.

When reporting results concerning toxic substances, the data should always be accompanied by a statement of their significance in terms of health or ecological effects and the criteria used in making such a statement.

Data Storage and Retrieval

AMBIENT DATA

The EPA requires its offices, and strongly encourages the States, to submit their ambient water quality data for storage in the EPA's STORET system.

If a State does not desire to use the STORET system, ambient water quality data should then be submitted to the EPA Regional Office preferably in a STORET-compatible form, or, minimally, in a machine-readable form having the minimum STORET identifiers. The State should review the data being forwarded to assure that any errors in transcription have been corrected. Data should be submitted at least quarterly.

Storing data and utilizing the STORET system will facilitate data interpretation and presentation in that:

1. Essential interpretive and presentation techniques are available;
2. Data interpretation and presentation on a full complement of data stored within a single computer system will save resources and provide a standard nomenclature;
3. Quality assurance indicators are included with data submission.

If a State wishes to become a STORET user it should first contact the appropriate EPA Regional Office or the EPA STORET User Assistance Branch (Telephone: 202–426–7792).

EFFLUENT DATA

The State should prepare and submit to the Regions on a quarterly basis an abstract containing the following:

1. The number, name and date of each sampling inspection of a major permittee; and,
2. The number, name and date of each compliance evaluation inspection of a major permittee.

INTENSIVE SURVEY DATA

For each intensive survey conducted, the State should prepare a very brief abstract (two-to-three pages) describing the survey area and briefly summarizing the results of the survey. These abstracts should be forwarded to the EPA Region upon completion. A sample outline is given in Appendix F.

These abstracts are to be maintained in basin files by the Region to serve as a reference on the water quality and discharge conditions in each basin.

APPENDICES

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Appendix A
National Ambient Monitoring
Program Station Description Form

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Hydrological classification (river, lake, impoundment, estuary, bay)_____

Land use classification (municipal / industrial, agricultural / rural, wilderness)_____

Water use classification (drinking water, recreational, commercial fishing / shellfishing, irrigation, navigation)_____

Major dischargers:

Name	Permit #	Name	Permit #

General description of area: (hydrology, population, climatology, etc.)

_____

_____

_____

_____

_____

Station description: Single ( ) Paired ( ) Sister station(s) (if paired) ( ) station # ( ) station #

Name of waterbody: _____

Station name : _____

STORET No. (Agency code / station #) : _____

State : _____

County : _____

Latitude : _____

Longitude : _____

Stream miles between stations (if paired) : _____

Remarks: _____

Appendix B

Ambient Monitoring Program Specifications

Station Siting Criteria

The primary concern for a national assessment is to select stations in water use areas such as recreational areas, commercial or sports fishery areas, shellfish areas, populated areas especially around raw surface water supply intakes, land use areas such as municipal/industrial and agricultural/rural and potential areas of development.

When selecting stations, emphasis should not be placed solely on problem areas. If this program is to depict a *national* assessment, it must also include relatively clean water areas of concern.

For this program, stations should be sited so that a representative sample of these different water areas can be obtained regionally.

Wherever possible, stations should be located at sites where historical data are available for correlation purposes.

RIVERS AND STREAMS

Ambient network stations should be sited according to any one or combination of the following options:

1. In a paired configuration. For example, upstream and downstream of representative land use areas (that is, municipal/industrial, agricultural/rural).
   These stations will be used primarily to measure the success of abatement activities at the national level.
2. Single stations located in small and homogeneous subbasins.
   These stations may be located in specific water use areas, for example: at surface water supply intakes, within recreational areas, or within commercial fishing and shellfishing areas.
3. At locations within major rivers and significant tributaries.
   For example, these stations may be located:
   - At the major outlets from and inputs to lakes, impoundments, estuaries or coastal areas; or
   - At the mouths of major intrastate and interstate streams and significant tributaries to these streams, etc.

LAKES AND IMPOUNDMENTS

Ambient stations in lakes and impoundments should be sited according to any one or combination of the following options:

1. At critical locations within eutrophic or potentially eutrophic lakes and impoundments.
2. In the following water use areas:
   a) at or near surface water supply intakes;
   b) in recreational areas; or,
   c) in commercial fishing and shellfishing areas.

ESTUARIES AND BAYS

Ambient stations in estuaries and bays should be sited according to any one or combination of the following options:

1. At selected locations in estuaries in areas of critical water quality problems or areas where maintenance of existing high quality water is critical.
2. At locations within the following estuaries:

NOTE

These estuaries were selected because they have great socio-economic value and pollution potential and encompass a variety of estuarine types.

Prince William Sound	Chesapeake Bay
Puget Sound	Delaware Bay
San Francisco Bay	Long Island Sound
Galveston Bay	Louisiana Marsh
Escambia Bay	

3. In the following water use areas:
   a) in recreational areas; or
   b) in commercial fishing or shellfishing areas.

Parameter Coverage and Sampling Frequency

Table 2 shows the parameter list and sampling frequencies for each hydrologic area. These parameters are considered necessary to assess water quality nationally. In order to promote consistency within the network (a necessity when developing useable national water quality analyses), Table 2 must be applied to each station in the ambient "core" program. Parametric coverage is not limited to those substances that are known to be a problem, but also includes substances that can reasonably be expected to become a problem. One purpose of this network is to identify emerging problems as well as to monitor existing problems. No substitutions may be made to this list. Table 2 will be reviewed annually. At that time, amendments may be made based upon proper justification (for example, if the concentrations of certain parameters are found to be insignificant over time, the frequency may be relaxed).

Minimum detection limits for each parameter are given in Table 3.

Where fish/shellfish tissue samples reveal

TABLE 2
MINIMUM PARAMETER LIST AND SAMPLING FREQUENCY FOR THE BASIC AMBIENT MONITORING PROGRAM

Parameter (Units)	*(STORET parameters code)*	*Sampling frequency*
Rivers and Streams		
Temperature (°C)	(00010)	monthly
Dissolved oxygen (mg/l)	(00300)	monthly
pH (Standard Units)	(00400)	monthly
Conductivity (umhos/cm @ 25°C)	(00095)	monthly
Fecal coliform (/100ml)	(31616)	monthly
Total Kjeldahl nitrogen (mg/l)	(00625)	monthly
Nitrate + nitrite (mg/l)	(00630)	monthly
Total phosphorus (mg/l)	(00665)	monthly
Chemical oxygen demand (mg/l)	(00335)	monthly
Total suspended solids (mg/l)	(00530)	monthly
Representative fish/shellfish tissue analysis (see Table 4)		annually
Flow (CFS)	(00060)	monthly
Lakes and Impoundments, including the Great Lakes		
pH (Standard Units)	(00400)	seasonally
Temperature (°C)	(00010)	seasonally
Dissolved oxygen (mg/l)	(00300)	seasonally
Conductivity (umhos/cm @ 25°C	(00095)	seasonally
Fecal coliform (/100ml)	(31616)	seasonally
Total phosphorus (mg/l)	(00665)	seasonally
Total Kjeldahl nitrogen (mg/l)	(00625)	seasonally
Nitrate + nitrite (mg/l)	(00630)	seasonally
Total suspended solids (mg/l)	(00530)	seasonally
Representative fish/shellfish tissue analysis (see Table 4)		annually
Transparency, Secchi disc (meters)	(00078)	seasonally
Estuaries and Bays		
Temperature (°C)	(00010)	monthly
Dissolved oxygen (mg/l)	(00300)	monthly
Total organic carbon (mg/l)	(00680)	monthly
pH (Standard Units)	(00400)	monthly
Salinity (‰)	(00480)	monthly
Fecal coliform (/100ml)	(31616)	monthly
Total Kjeldahl nitrogen (mg/l)	(00625)	monthly
Total phosphorus (mg/l)	(00665)	monthly
Nitrate + nitrite (mg/l)	(00630)	monthly
Total suspended solids (mg/l)	(00530)	monthly
Representative fish/shellfish tissue analysis (see Table 4)		annually
Transparency, Secchi disc (meters)	(00078)	monthly

TABLE 3
DETECTION LIMITS FOR AMBIENT MEASUREMENTS*

Parameter (units)	*Detection limit*
Temperature (°C)	0.1
Dissolved oxygen (mg/l)	0.1
pH (standard units)	0.1
Conductivity (umhos/cm @ 25°C)	1
Salinity (°/₀₀)	0.1
Fecal coliform (/100 ml)	1
Trace metals, total (ug/l)	
Arsenic	10
Cadmium**	20
Copper**	50
Chromium**	50
Mercury	0.1
Lead**	200
*Total Kjeldahl nitrogen (mg/l)	0.1
Nitrate + nitrite (mg/l)	0.01
Total phosphorus (mg/l)	0.01
Chemical oxygen demand (mg/l)	5
Total organic carbon (mg/l)	0.5
Total suspended solids (mg/l)	5

*Detection limits that are achievable by the average analyst in an average laboratory using the approved Section 304(g) test procedures.

**Detection limit may be improved by a factor of 10 by using recommended extraction techniques.

high concentrations of a particular toxicant(s), sediment samples should then be collected and analyzed for that parameter, wherever possible. If these samples also reveal high concentrations, grab samples from the water column should then be collected and analyzed. Parameter units and STORET parameter codes for trace organic analyses in the water column are given in Table 5.

The parameters given in Tables 2, 4, and 5 were chosen because:

1. They reflect a broad range of water quality conditions and water quality problems:
   - Temperature, pH and dissolved oxygen are included because they are primary parameters in most chemical reactions that occur within the water body. They are also essential factors that govern whether the ecosystem will maintain aquatic life and are recognized as such in State water quality standards.

TABLE 4
TRACE ORGANIC AND METALS ANALYSIS FOR FISH/SHELLFISH TISSUE AND SEDIMENTS

Parameter	*STORET parameter code*	
Weight (fish/shellfish only)	(pounds) (00023)	
% lipid content (fish/shellfish only)	(%) (39105)	
	Tissue (mg/kg ug/g)	Sediments (ug/kg)
PCBs	(39515)	(39519)
Aldrin	(34680)	(39333)
Dieldrin	(39404)	(39383)
Total DDT	(39376)	(39389)
o,p DDE	(39329)	(39328)
p,p' DDE	(39322)	(39321)
o,p DDD	(39325)	(39316)
p,p' DDD	(39312)	(39311)
o,p DDT	(39307)	(39306)
p,p' DDT	(39302)	(39301)
Chlordane	(34682)	(39351)
cis isomer of chlordane	(39063)	(39064)
trans isomer of chlordane	(39066)	(39067)
cis isomer of nonachlor	(39069)	(39070)
trans isomer of nonachlor	(39072)	(39073)
Endrin	(34685)	(39393)
Methoxychlor	(39482) (ug/kg)	(39481)
Hexachlorobenzene	(34688)	(39701)
Pentachlorophenol	(39060)	(39061)
Hexachlorocyclohexane		
alpha BHC isomer	(39074)	(39076)
gamma isomer	(39785)	(39343)
Arsenic	(01004)	(01003) (mg/kg)
Cadmium	(71940)	(01028) (mg/kg)
Chromium	(71939)	(01029) (mg/kg)
Copper	(71937)	(01043) (mg/kg)
Mercury	(71930)	(71921) (mg/kg)
Lead	(71936)	(01052) (mg/kg)

TABLE 5
TRACE ORGANIC AND METALS ANALYSIS

Parameter	STORET parameter code (ug/l)
PCBs	(39516)
Aldrin	(39330)
Dieldrin	(39380)
Total DDT	
o,p DDE	(39327)
p,p' DDE	(39320)
o,p DDD	(39315)
p,p' DDD	(39310)
o,p DDT	(39305)
p,p' DDT	(39300)
Chlordane	(39350)
cis isomer of chlordane	(39062)
trans isomer of chlordane	(39065)
cis isomer of nonachlor	(39068)
trans isomer of nonachlor	(39071)
Endrin	(39390)
Methoxychlor	(39480)
Hexachlorocyclohexane	
alpha BHC isomer	(39337)
gamma isomer	(39340)
Hexachlorobenzene	(39700)
Pentachlorophenol	(39032)
Arsenic, total	(01002)
Cadmium, total	(01027)
Copper, total	(01042)
Chromium, total	(01034)
Mercury, total	(71900)
Lead, total	(01051)

Temperature is also needed in order to correct conductivity measurements at ambient temperatures to equivalent (standard) values at 25 degrees C. If a temperature compensated meter is not used.

- A conductivity measurement is included to determine the degree to which dissolved solids are part of the water quality. This is a most reliable measurement and can be done on site. Salinity is measured in estuaries and bays.
- Fecal coliform is included because it is at present the most reliable test for indicating the possible presence of pathogenic microorganisms in the water column.
- Trace metals were limited to those that are of high priority and are toxic. Since the concern of the program is to measure the total load, total metals instead of dissolved forms are measured.
- To determine the extent of total nutrient contribution, total phosphorus, total Kjeldahl nitrogen and nitrite + nitrate are measured.
  Since the basic concern of the program is the total nutrient load, total phosphorus is measured instead of the other various forms of phosphorus. This is also less costly.
  In determining the addition of nitrogen to the Nation's waters, the concern of the program is to arrive at some understanding of the stage of nitrification within the system. Therefore, total Kjeldahl nitrogen is included as a measurement of organic nitrogen and ammonia, and nitrate + nitrite is included to determine the extent of oxidized nitrogen.
- A total suspended solids measurement is included to measure the contribution of solid material to the system and to give some indication of water clarity and the probability of chemical adsorption.
- A chemical oxygen demand (COD) measurement is included as an indication of the oxygen demand placed on the system. Chemical oxygen demand was chosen over biochemical oxygen demand (BOD) or total organic carbon (TOC) because it is more reliable than BOD, does not involve problems with holding time and sample transport as do BOD samples, and does not require the sophisticated equipment required of a TOC measurement. COD is not measured in lakes and impoundments since it is usually found only in such low concentrations that it renders the measurement meaningless. TOC is measured in estuaries because the COD measurement does not yield satisfactory results in salt water due to chloride interference.
- The trace organics included in the program were chosen because they appear most frequently on the priority lists of toxic substances. For example, measurements required for the permit program, measurements required for the drinking water program, the Section 307(a) list and several listings pro-

posed by the EPA Office of Toxic Substances were consulted.

- Flow is included for proper data analysis and it is necessary to determine stream loadings.
- Transparency, Secchi disc is included in lakes, impoundments, estuaries and bays because the results are easily understood by the layman and it is a very simple measurement of water clarity.
- The effects of contaminants on aquatic organisms are complex. Synergistic chemical/physical reactions, biomagnification and other natural events cannot be easily quantified. For these reasons and for the purposes of this program, the best approach, at this time to determine the presence and therefore the potential health threat of toxic substances in the ecosystem appears to be the chemical analysis of fish and shellfish tissue.

2. These parameters are regulated through EPA guidelines, regulations, criteria and standards; and,
3. Sound and approved sampling and analytical techniques are available to measure the parameters.

Sample Collection and Analysis

It is most important that stations be sited properly and that samples collected at the site provide the best representation of the water quality. Transects, composite sampling, and any other special sampling techniques should be used to fix the sampling sites, where appropriate, and should be properly noted when the station is established. The sampling pattern should be determined through a site evaluation study made at the time the site is first selected. Station sites should then be reviewed periodically (at least every five years) to see if changes in the waterbody such as dams, excavations, dredging etc., have altered conditions.

In rivers, one representative water sample should be collected. In homogeneous lakes, impoundments, estuaries, and bays, one representative water sample should be collected. If stratified, one sample should be collected from each stratum. In estuaries and bays, sampling should be done at low tide slack water, wherever possible. Mixing properties and any other characteristics that may affect data interpretation should be noted.

The detailed monitoring of individual lakes, impoundments, estuaries and bays will be accomplished through intensive surveys. However, ambient stations located in these water bodies and designated as part of the ambient program must comply with the specifications in Table 2.

Wherever possible, the representative* fish samples should be collected annually in the fall and analyzed according to the established documentation (see "References"). Residue levels are much more severe at this time of year because: The fish have just been subjected to an increased use of pesticides during the agricultural growing season; there are more resident populations of fish in the fall (migrations usually occur in the spring); the summer months are the active feeding season for fish, food chain relationships are better-defined and peak in the fall; and, spawning, which can substantially reduce contaminant concentrations in fish, usually occurs in the spring.

Two replicate whole fish composite samples of a representative bottom feeder and one whole fish composite sample of a predator species should be collected at each station. Commercially or recreationally important species should be collected, wherever possible. Each composite should include at least five fish, each of approximately the same size.

Because of their great water filtering capabilities, shellfish are excellent concentrators of contaminants. Therefore, wherever possible, representative shellfish samples should be collected and analyzed, especially in estuarine environments.

Tissue Banking*

After sample aliquots are analyzed for the parameters listed in Table 4, the remainder of the tissue sample should be tagged, preserved, according to recommended methodology (see "References"), and stored for one

*Only fish samples that will be most representative of the water quality in the area should be collected for tissue analysis. Migratory fish should be discounted.

year. These samples will be stored in EPA sponsored national laboratories. This "Tissue Banking" procedure is being adopted to respond to future individual hazardous substance problems (such as kepone, PCBs etc.) that may arise.

The following information should be included with the stored tissue samples.

1. Sample description (species, approximate size, weight, % lipid, etc.)
2. Date of collection day/month/year
3. Station #_____
4. State_____
5. Who collected the sample, name, phone #
6. Who analyzed the sample, name, phone #
7. Sample collection method_____
8. Method of preservation_____
9. Condition of fish at the timeof collection _____ _____.

The program will operate as follows: Upon identification of a hazardous substance problem, stored tissue samples will be immediately withdrawn and analyzed for the identified pollutant. This information will then be correlated nationally, documented, and presented in report form to the EPA Administrator.

Also, if the problem pollutant requires additional attention, it may be added to the ambient parameter list (Table 4).

References

1. Analysis of Pesticide Residues in Human and Environmental Samples, USEPA, Perrine Private Research Laboratories, Perrine, Florida, 32157, 1970.

2. Handbook of Procedures for Pesticide Residue Analysis, U.S. Department of the Interior, Fish and Wildlife Service, Bureau of Sports, Fisheries and Wildlife, Washington D.C., August, 1972.

3. Guideline on Analytical Methodology for Pesticide Residue Monitoring, Federal Working Group on Pest Management, Washington, D.C., 20460, June, 1975.

4. Pesticide Analytical Manual, Volumes I and II, U.S. Department of Health, Education and Welfare, Food and Drug Administration, Washington D.C., December, 1971.

5. Manual of Chemical Methods for Pesticides and Devices, USEPA, Office of Pesticide Programs, Technical Services Division, Chemical and Biological Investigations Branch, Published by AOAC, July, 1976.

Appendix C

Section 305(b) Report Outline

Summary

The summary should briefly (in about five pages) highlight the important conclusions from each chapter in the text, following the same basic outline. Particular emphasis should be placed on the conclusions affecting policy issues, such as the degree of water quality improvement that can be expected under current programs, the incremental benefits and costs of going from Best Practicable Technology (BPT) to Best Available Technology (BAT) industrial control levels, and any other issues which are of conern.

In addition, a map indicating those waters currently supporting fishing and swimming, those waters not currently supporting fishing and swimming but expected to by 1983, and those waters not expected to support fishing and swimming by 1983 should be a part of the report.

If there is no change in the water quality of a given basin, the State need only cite the previous report and abstract the information contained therein.

Chapter 1: Current Water Quality and Recent Trends

A. Waters currently meeting the "fishable, swimmable" standards, as a percentage of total surface waters in the State. Identify reasons for these waters not meeting standards. This section shall include a summary similar to that shown in Table 6.

B. Major problem areas.

C. Statewide analysis of water quality by basin or river segment.
   A very brief description of the area followed by a general description of the water quality in each area. Water quality should be described in reference to the intended use.

Chapter 2: Water Quality Goals and Control Programs

A. 1983 Water Quality Goals
   1. Percentage of waters for which it is projected that the "fishable, swimmable" standards will be met by 1983.
   2. Percentage of waters, and their location, in which natural conditions will preclude fishing and/or swimming in 1983, and reasons.
   3. Percentage of waters, and their location, in which human influence will prevent attainment of "fishable, swimmable" standards in 1983, and reasons.
      Reasons for inability to meet goals, i.e.,:
      Specific point sources
      Specific nonpoint sources
      Lack of funds
      Administration problems.

B. Effects of Control Programs on Water Quality
   1. Description of programs
      a. Point source control.
      b. Nonpoint source control.
   2. Recent improvements in water quality resulting from control programs.
   3. Projected effect on water quality of future programs, including the incremental improvement expected in going from BPT to BAT.

C. Recommendations concerning programs, legislation, administration, etc.

Chapter 3: Costs and Benefits

A. Costs
   1. Municipal
      a. 1974 "Needs Survey" with any updates.
      b. Costs to meet water quality goals, if different from "Needs Survey".

TABLE 6
WATER QUALITY SUMMARY

Basin

Segment number	Total miles	Miles now meeting Class B (fishable/ swimmable)	Miles expected to meet Class B by 1983	Miles now meeting State W.Q Stds.	Miles not meeting State W.Q.	Water quality problems*	Point source cause of W.Q. problems M = Municipal I = Industrial	Nonpoint source cause of problems 1 = Major 2 = Minor 3 = N/A
1-1	1.5	0	1.5	1.5	0	2,6,1	M,I	
1-2	5.0	0	5.0	1.0	4.0	1,2,6,5	I	
3	5.5	1.0	5.5	1.0	4.5	6	M	
1-4	2.5	0	0	0	2.5	1,2,5	M,I	
1-5	5.0	3	5.0	3	2	6	M	
1-6	4.5	3.0	4.5	3.0	1.5	5,6		
1-7	11.5	11.5	11.5	11.5	0		M	
1-8	7.0	6.0	7.0	6.0	1.0	6	M	
1-9	3.0	0	3.0	0	3.0	6	M	

SEGMENT DESCRIPTION

1-1 Hoosic River—Mass. state line to Pownal
1-2 Hoosic River—Pownal to New York state line
1-3 Walloomsac River—Bennington to Paran Creek
1-4 Walloomsac River—Paran Creek to New York state line
1-5 Paran Creek—S. Shaftsbury to Walloomsac River
1-6 No Name Brook—Fairdale Farms to Walloomsac River
1-7 Batten Kill River—Manchester Center Depot to Arlington
1-8 Batten Kill River—Arlington to New York state line
1-9 Warm Brook—Fayville Branch to Batten Kill

*Column 7—Water quality problems: 1: Harmful substances; 2. Physical modification (suspended solids, temperature, etc.); 3. Eutrophication potential; 4. Salinity, acidity, alkalinity; 5. Oxygen depletion; 6. Elevated coliform levels.

2. Industrial
   a. Costs to achieve BPT (1977) level treatment.
   b. Costs to achieve BAT (1983) level treatment.
3. Other point source control costs.
4. Nonpoint source control costs, by type of source.
   Are the erosion control programs of the Soil Conservation Service more or less than is required to meet water quality goals?

B. Benefits
1. Social and economic benefits resulting both from enactment of control programs and from attainment of high water quality. Quantify, wherever possible.
2. Costs vs. benefits for different levels of control.
   a. Statewide.
   b. By basin, river segment, etc.

Chapter 4: Nonpoint Sources

A. By category: Agricultural
Silvicultural
Mining
Construction
Hydrologic modification
Urban runoff
Residual waste disposal
Saltwater intrusion
Proposed energy development
Others

1. Sources.
2. Pollutants involved.
3. Extent of problem.
4. Severity of problem.
5. Loadings.
   a. Compare to point source loadings.
   b. Evaluate effect on water quality.

Tables 7 through 12 may be useful in summarizing water quality information.

TABLE 7

WATER QUALITY RELATIVE TO STANDARDS

Basin-
Parameter-

Segment	*Classification**	*Stream miles*	*Miles now meeting standards*	*Miles meeting standards by 1983*	*Sources of problems*

NOTE: If standards are different from the 1983 fishable/swimmable goals of PL 92-500, specify also the percentage of stream miles now meeting those goals and the percentage expected to meet the goals by 1983. Explain why the standards are different from the goals (i.e., natural conditions, technological or economic limitations, etc.).

*Include whether effluent limited or water quality limited and State classification (Table 2).

TABLE 8

STATE WATER QUALITY STANDARDS

Stream classification	*Water uses*	*Parameter*	*Standard*
A	xxx	xxx	xxx
	xxx	xxx	xxx
		xxx	xxx
B	xxx	xxx	xxx
		xxx	xxx
etc.			

TABLE 9

DISCHARGER INVENTORY

Type—(Municipal or Industrial)
Basin—

Name	*Receiving segment*	*Parameter*	*Current discharge*	*Final permit limitation*	*Basis for limitation**	*Compliance date*

*Effluent limited or water quality limited. If water quality limited, give effluent limitation that would apply.

TABLE 10

NONPOINT SOURCE PROBLEM SUMMARY

Basin—
Parameter—

Category	*Stream miles affected*	*Percent of total stream miles*	*Severity of problem**	*Estimated loadings*	*Degree of control possible*
Urban runoff					
Agriculture					
Silviculture					
Mining					
Construction					
Hydrologic modification					
Other**					

*What if any standards are being violated?
**Specify.

TABLE 11

POLLUTANT SOURCES

Basin—
Segment—
Parameter—

	Total loading (lbs.)	*Seasonal*	*Standards violation rate*	*Percentage* of violations caused by*
Industrial				
Municipal				
Urban runoff				
Agriculture				
Other NPS**				

*As a minimum, determine whether violations occur during dry or wet weather periods.
**Specify.

TABLE 12

COSTS OF POLLUTION CONTROL

Basin—

Municipal

- "Needs" survey summary by category
- Estimated year-by-year expenditures

Industrial

Category	Cost Estimates (1)	
	BPT level treatment (2)	BAT level treatment

(1) Based on surveys, permits, etc.
(2) Costs to meet existing permit conditions

Nonpoint Source

Category	Costs to achieve Best Management Practices
Urban runoff	
Agriculture	
Silviculture	
Mining (includes abandoned mines)	
Construction	
Hydrologic modification	
Other (specify)	

Appendix D

Cost

Cost

Monitoring funds to support this program are through the PL 92-500 Section 106(e)(1) grant to the States.

The following is an estimated cost analysis for a station designated as part of the basic ambient monitoring program. These figures are based on the specifications stated in Chapter 4 and refer only to those currently operating stations that are designated as part of the basic ambient program.

	Dollars/Station/Year		
	Stream	*Lake*	*Estuary/Bay*
Sample collection (labor) (20%)	479-685	202-289	513-733
Vehicle rental + mileage (10-25%) (10-15% in lakes and estuaries)	240-855	101-217	256-549
Miscellaneous (includes boat/motor rental, shipping costs, etc.) (5%) 5-15% in lakes and estuaries	120-171	51-217	128-549
Laboratory analysis (35-50%)	1,198	506*	1,282*
Quality control** (15%)	359-513	152-217	385-549
Total range	2,396-3,422	1,012-1,446	2,564-3,663

*See Table 13 for breakdown.

**This includes:

- Replicate samples done 5-10% of the time;
- Spike samples done 5-10% of the time;
- Reference samples done once per quarter; and,
- Performance samples done once per year.

The cost estimate for laboratory analysis is known. For the purpose of this exercise it will therefore remained fixed.

Based on a general survey of USGS cost estimates for the NWQSS, the percent of total cost attributed to the laboratory analysis varied from approximately 35-50 percent. This was due primarily to the variability of field sampling costs (distance traveled, vehicle rental, labor) in certain areas.

Therefore, in this exercise, the percent of total cost attributed to laboratory analysis was fixed at 35 percent and then at 50 percent while the actual cost of analysis remained the same. In this way, a range of total cost per station was determined.

TABLE 13

COST OF LABORATORY ANALYSIS FOR THE AMBIENT MONITORING PROGRAM

Parameter	*Cost/Sampler/Dollar*
Temperature	2
Dissolved oxygen	5
pH	3
Conductivity	5
Salinity	5
Fecal coliform	15
Total Kjeldahl nitrogen	15
Nitrate and nitrite	6
Total phosphorus	7
Total suspended solids	6
Chemical oxygen demand	15
Total organic carbon	22
Fish/shellfish tissue analysis	250

The figures in Table 13 do not reflect cost of sample collection and shipment to the laboratory. Overall, the average cost is approximately $10/constituent/sample. If a large number of samples were being analyzed on a daily basis by a laboratory, this cost would be reduced by a factor of approximately three, that is, $3/constituent/sample.

The following table estimates manpower requirements for intensive surveys and an average total cost figure.

STORET Funding

EPA provides funds for STORET computer support annually to non-EPA agencies. On the average, it costs one cent per observation to place data in the STORET system and approximately four dollars per retrieval for ten years of data from one hundred stations from twenty

parameters via a high speed remote terminal. Retrievals run from a low speed terminal cost approximately four dollars more.

On the average, it takes .02 man hours per 1,000 observations to prepare data for matching and subsequent verification. On the average, 129 keystrokes per observation are required for matching, i.e., keypunching.

TABLE 14

ESTIMATED MANPOWER REQUIREMENTS FOR INTENSIVE SURVEYS

(Source: USEPA, Model State Water Monitoring Program)

Activity	*Personnel*	*(Manweeks)*	*Remarks*
Initial planning	Field party chief* and laboratory personnel	2MW	Assemble maps and post data
Reconnaissance	Field party chief* and biologist	1MW	Select sampling sites and synoptic biological screening
Mobilize field equipment and crew technicians and laboratory crews	Field party chief*	1MW	Get all equipment together and ensure it is in working order.
Field sampling	Field party chief* 2 laboratory crew 3 technicians 1 biologist	1MW 3MW 4MW 1MW	Field sample collection and field laboratory analyses
Fixed laboratory analyses chemistry and biology	Chemist Biologist	15MW 3MW	Assume 20 samples per day for 15 parameters, chemistry and plankton, and invertebrate identification, and enumeration
Data analyses report preparation	Field party chief* chemist and microbiologist, typist	3MW	Analyze data, write and type report
		Total 34MW	

Total cost/year = 34/48 x $20,000.00** = $14,000
(Does not include overhead cost of ⅓ for fringe benefits)

*In estuarine environments this would be an oceanographer.

**Based on estimate of 48MW per MY and an average salary of $20,000.00/MY.

Appendix E

Overview of Water Monitoring

Standing Work Group on Water Monitoring

May 20, 1976

Introduction

Serious management and other deficiencies in the EPA's Water Monitoring Programs were identified in 1975 during a series of briefings held within the Agency. The most important shortcoming was the lack of an overall EPA/State water monitoring conceptual framework. In order to develop such a strategy and to examine problem areas that might be identified, the Deputy Administrator established the Standing Work Group on Water Monitoring (Work Group) in December, 1975. The Work Group consists of members from four Headquarters Offices, two Regions, and five States.*

The Work Group's first task was to develop a road perspective on monitoring activities, uses, problems and potential solutions. This was handled primarily through a series of interviews with 27 Headquarters' officials responsible for administering monitoring systems or involved in using monitoring data. In order to obtain specific data and to help promote responsiveness, a questionnaire in the form of a matrix was provided each person in advance of the interview (Attachment 1). Through the questionnaire, each interviewee was asked to (1) prioritize monitoring activities for which he had responsibilities, (2) specify the kinds of data needed to support the activities, (3) identify data sources, and (4) identify primary monitoring constraints. Information obtained from the interviews was supplemented by similar information provided by EPA Regions and States.

This paper summarizes the results of the "overview" effort. Following this introduction are discussions of the institutional setting of the EPA's monitoring program, the uses of monitoring data, monitoring systems, data systems, monitoring costs, monitoring problems, and a program of suggested follow-up efforts.

*Members: Robert Crim, Chairman, Office of Water and Hazardous Materials; Robert Booth, Office of Research and Development; Dave Lyons, Office of Enforcement; Truman Price, Office of Planning and Management; Fred Grant, Water Division, Region III; Chris Timm, Surveillance and Analysis Division, Region V; Dick Cunningham, State of Washington; Jerry McKersie, State of Wisconsin; Henry Silbermann, State of Maryland; Tim Stuart, State of Florida; Linda Wyatt, State of Texas.

Institutional Setting

The institutional setting in which the EPA conducts its water monitoring activities is complex. This stems primarily from the multiple legislative authorities that control program activities, the wide dispersion of responsibility for various monitoring functions at both Headquarters and in the field, and the heavy involvement of non-EPA participants.

The legislative authorities stem mainly from six Acts:

- The Federal Water Pollution Control Act.
- The Safe Drinking Water Act.
- The Refuse Act.
- The Marine Protection, Research and Sanctuaries Act.
- The Federal Insecticide, Fungicide, and Rodenticide Act.
- The Solid Waste Disposal Act.

The monitoring responsibilities—encompassing both the collection and use of data—are highly decentralized. At Headquarters, 16 offices, under five Assistant Administrators, are involved in various monitoring functions (Attachment 2). Similarly, field responsibilities are dispersed among the 10 Regional Offices

(Attachment 3) and 13 research laboratories (Attachment 4).

The institutional relationships are further complicated by heavy involvement of other Federal agencies—principally the U.S. Geological Survey (USGS)—the States, and pollutant dischargers operating under effluent permits.

Monitoring Uses

Monitoring data are used in a variety of ways, require an array of support systems, and involve a wide variety of program activities. Basically, data needs fall into four broad categories.

1. **Provide Data for Developing, Assessing, and Revising National Strategies and Control Programs.**

In the development of national control strategies, monitoring data are needed primarily to assess trends and develop environmental indicators. These measures are needed to provide focus to the strategy-setting process, especially with regard to selecting among alternative program strategies and resource allocations. The types of data required vary with the type of strategy under development: Point source strategies need ambient data as well as effluent data; nonpoint source strategies need ambient data as well as intensive survey data: drinking water strategies need intake ambient data and treatment plant output data; and toxic and hazardous pollutant strategies need all of these data.

The measurement of progress toward achieving program objectives is a high-priority use of monitoring data. Program managers need indicators of their accomplishments based on measurable quantities for several reasons:

- To provide support in selecting program alternatives.
- To provide support in allocating resources, and to channel work activity in the most productive directions.
- To provide feedback and evaluate accomplishments.
- To set performance standards for program staffs.

As far as developing data to measure program achievements is concerned, baseline measurements are particularly important. If these measurements are not available, special efforts, including the design and execution of intensive surveys, must be undertaken.

2. **Provide Basic Data on the Effects of Pollutant Exposure in the Development of Revision of Models, Criteria, and Standards.**

Monitoring data for developing models, criteria, and standards are of major importance to the EPA, primarily because most of its water pollution control activities rest on these areas. Some of the most important uses in this category involve the following.

- Water Quality Models

  Data from intensive or special surveys are used extensively to develop and verify water quality models. This is particularly the case where complex hydrologic conditions exist such as in estuaries and streams with poor mixing.

- Water Quality Criteria/Ambient Water Quality Standards

  The Federal Water Pollution Control Act (FWPCA) requires States to adopt and enforce water quality standards for all navigable waters. Each standard consists of: (1) criteria, representing the acceptable limits of pollutants in receiving waters to protect the designated use or uses of water; and (2) a plan of implementation and enforcement. In development or revision of criteria, all types of monitoring data are used. Criteria for health-related uses such as domestic supplies, protection and propagation of aquatic life, and water-based recreation rely to a major extent on measurements of dissolved oxygen and on biological and toxic monitoring data. Criteria for most other users tend to rely on the more traditional monitoring parameters such as temperature, turbidity, pH, and dissolved solids.

- Drinking Water Standards

  The Safe Drinking Water Act of 1974 requires the development of nationwide maximum contaminant levels—or standards—for domestic water supplies. Traditionally, monitoring for domestic water supplies has emphasized fecal coliform, a measure of bacteriological activity. At the present time, increasing attention is being directed toward viruses and potentially toxic

substances such as heavy metals and chlorinated hydro-carbons. To develop standards for these emerging pollutant areas, biological monitoring data as well as physical/chemical data (often requiring sophisticated sampling and analysis techniques) are needed.

- Effluent Standards

  The FWPCA requires the EPA to establish separate effluent standards for municipal and industrial dischargers. The discharge of heat and toxic pollutants receives special consideration. Municipalities are required to provide secondary treatment by mid-1977 and "best practicable waste treatment technology" (BPWTT) by mid-1983. In developing a definition of BPWTT, monitoring data, primarily on alternative waste management techniques, are needed.

  Two salient requirements are imposed upon industrial dischargers: Existing industries must use the "best practicable control technology currently available" by mid-1977; and "best available technology economically achievable" by mid-1983. Since effluent limitations must be developed for 46 major industrial categories and additional lesser categories, the need for specialized effluent monitoring data is great.

  In addition, new sources of industrial pollution must use the "best available demonstrated control technology" (BADCT) which the EPA is defining in the form of standards of performance for various industries. Again, effluent monitoring data are needed in defining BADCT for the various categories.

  The FWPCA also requires standards for industries whose effluents are treated by municipal treatment plants. In cases where the municipal plants cannot effectively treat the effluents, pretreatment standards are required. Development of these standards also requires detailed effluent monitoring data.

- Thermal Standards

  Discharge of heat is considered a pollutant under the FWPCA, so it is subject to water quality standards. Thermal standards are set for ambient waters as well as point source dischargers. Development of such standards requires monitoring data, especially data that provide information on the responses of aquatic life to temperature changes and levels.

- Toxic Standards

  The FWPCA provides for control of toxic pollutants through special effluent guidelines and ambient standards. Since dose-response relationships for many toxic substances are not fully known, there is great need for specialized monitoring. Sophisticated sampling and analytical techniques are frequently required because of the very low concentrations dealt with in monitoring toxic pollutants. Because of difficulties with physical/chemical monitoring at low concentrations, increasing attention is being afforded biological monitoring.

3. Provide Data, Including Information on Baseline Conditions, for Developing and Revising Local Pollution Control Plans and Permits.

Monitoring data are needed for four planning programs and three permit programs.

- Section 208 Areawide Plans

  Areawide planning integrates many elements of water pollution control, including those which apply to point sources, nonpoint sources, and upstream sources. Extensive monitoring data—effluent, ambient, and biological—are needed to adequately integrate these elements and devise broad control plans.

- Section 303 Basin Plans

  More detailed water quality information is developed in basin planning, including:

  —A display of in-stream water quality data to indicate that segments are properly classified as effluent-limited or water-quality-limited.

  —An inventory and ranking of significant municipal discharges, and an inventory of significant industrial dischargers.

—Recommendations for revising water quality standards.

In addition, plans for water-quality-limited segments include:

—An assessment of total maximum daily loads necessary to meet water quality standards.

—Established or targeted waste load allocations and effluent limitations.

—An assessment of nonpoint source pollution.

Extensive water monitoring data are needed to develop these planning outputs. In many cases, intensive or special surveys must be made.

- Section 201 Facilities Plan

  The impacts of alternative treatment schemes must be examined in order to develop plans for municipal treatment facilities. Primarily, ambient data are needed to conduct such examinations.

- Pesticides Monitoring Plans

  The Federal Insecticide, Fungicide, and Rodenticide Act requires the EPA to formulate and periodically revise, in cooperation with other agencies, a national plan for monitoring pesticides. The plan is to be restricted to ambient monitoring designed to assess the levels of pesticides in representative segments of the environment. Considerable monitoring data—biological as well as physical/chemical—will be needed to design and revise the national plan.

- NPDES Permits

  The FWPCA requires that any discharge into the Nation's navigable waters from any point source may be made only in accordance with conditions of a discharge permit. Usually, the permit conditions conform to nationwide standards such as best practicable technology, best available technology, and BPWTT. In the case of water-quality-limited segments of water bodies, however, limitations more stringent than nationwide standards may be required. In order to determine the levels of control needed, extensive use of effluent as well as ambient monitoring data is needed.

- Dredge or Fill Permits

  The U.S. Army Corps of Engineers is authorized by the FWPCA to issue permits for disposal of dredged or fill materials in navigable waters. The EPA frequently uses monitoring data to assess the impacts of such permits to prepare review comments by the Corps. Ambient and biological data are particularly important.

- Sewage Sludge Permits

  The FWPCA requires EPA to develop regulations governing issuance of permits for disposal of sewage sludge. In developing the regulations, monitoring data are required, primarily data on the migration of leachates to ground water aquifers and surface waters.

4. Provide Monitoring and Case Support Data for Enforcement Activities.

Once standards have been developed and permit conditions set, there is a continuing need for monitoring data to support enforcement activities. Data needs fall primarily into the following areas:

- NPDES Permits

  Compliance monitoring of NPDES permits is a major program area. This is handled primarily through review of self-monitoring reports, which are expected to total 120,000 in FY76. In many instances, however, follow-up monitoring is needed. This is handled by sampling and reconnaissance inspections (3,000 projected for FY76). When actions are taken against dischargers, additional monitoring is generally required. The extent of such monitoring varies considerably and may involve ambient as well as effluent measurements.

- Pretreatment Standards

  Industries that must meet pretreatment standards may be required to provide self-monitoring reports on their discharges. The EPA and/or the States will review these reports, if required, and conduct follow-up effluent monitoring inspections as necessary.

- Drinking Water Standards

  By mid-1979, it is expected that 240,000 water supply systems will be monitored for compliance with drinking

water standards. As in the case of NPDES permits, compliance will be handled primarily by reviewing self-monitoring reports. Again, as in the case of NPDES permits, the EPA and the States will need to conduct follow-up monitoring for compliance and support of enforcement actions.

- Sewage Sludge Permits

  Compliance monitoring requirements have not been developed for sewage sludge permits. If sites are properly selected, there may be no need for leachate monitoring.

- Dredge and Fill Permits

  Monitoring of dredge and fill areas will be determined to a major extent by the types of areas involved and specific permit requirements.

- Ocean Dumping Permits

  Monitoring of ocean dumping sites is needed primarily in the permit development process. In certain cases, however, continuing monitoring may be needed for compliance purposes.

- Oil and Hazardous Spills

  More than 10,000 spills occur annually in the United States. Approximately 80 percent of this total involves petroleum or petroleum products. The EPA responds to spills in inland waters, while the Coast Guard responds to those in coastal waters and the Great Lakes. In FY76, the EPA expects to investigate and/or prosecute 900 spill cases under civil penalties, and 40 spill cases under criminal penalties. In most of these cases, monitoring data will probably be required. The monitoring process may involve sophisticated techniques for identifying pollutants.

EPA Headquarters' personnel who use, or are responsible for monitoring data, have assigned priorities to the various uses. While these priorities vary considerably among individuals and program offices, certain uses are perceived as being of generally high priority (Attachment 5):

1. Measure progress toward achieving or maintaining ambient standards and legislative goals;
2. Provide research and other data for the development or revision of effluent standards, toxic standards, and pretreatment standards;
3. Develop/assess/revise point-source control strategies; and,
4. Allocate resources among activities.

EPA Headquarters' personnel have also identified the types of monitoring data needed to meet their responsibilities in the various use areas. As might be expected, they have the greatest need for ambient data (29 percent of total needs) followed closely by effluent data (26 percent) (Attachment 6). However, a substantial need is indicated for biological data (22 percent) and health data (15 percent).

Monitoring Systems

Monitoring data used by the EPA are derived from a variety of sources:

National Water Quality Surveillance System (NWQSS)

This system has 188 paired stations that are located above and below major types of land use areas, for example, industrial and agricultural areas. Most samples are collected and analyzed through a contract with the USGS. Data are stored in the STORET computer system.

NPDES Self-monitoring Reports

These reports are submitted by municipal and industrial dischargers. Generally, they are submitted on a monthly basis, with about 60,000 to be filed in FY76. The data are filed manually, but an automated system is currently being tested.

NPDES Sampling Inspections

It is anticipated that about 7,500 inspections will be undertaken in FY77. Data collected from these inspections are filed manually.

Toxic Monitoring

Two contracts have provided monitoring data on toxic substances; 200 ambient water samples have been collected and analyzed from the effluents of 150 industrial dischargers. Data from these surveys have been filed manually. Contracts are planned for additional surveys, and an automated data system is being considered.

National Organic Reconnaissance Survey (NORS)

This survey provides information on levels of organics in the drinking water supplies of 112 cities suspected of having water quality problems. The survey covers approximately 20 specific organic compounds deemed to be candidates for particular concern.

Environmental Radiation Ambient Monitoring System (ERAMS)

This system includes 55 ambient monitoring stations and 76 drinking water supply stations. The work is carried out through the Regional Offices, with analyses published quarterly. Data are filed manually.

Pesticides Monitoring Systems

Cooperatively with the USGS, the EPA monitors 152 stations for pesticides. Both water and sediment samples are collected from 17 major fresh water drainage basins and are analyzed for 25 pesticides. Data are stored in the STORET system. Estuarine and marine monitoring programs are also operating.

Landfill Leachate Monitoring

Approximately 10 landfill sites are monitored to determine effects of landfill runoff. The data are stored manually.

Regional Monitoring Activities

Although each Regional Office does not support a formal monitoring system, various monitoring activities are carried out, for example, intensive surveys for planning purposes, or monitoring a localized area for a specific pollutant. Several Regions support local geographic monitoring programs such as monitoring of ocean dumping sites. Regions also support the national monitoring systems as well as the State programs.

State Monitoring Programs

As required by "Water Quality and Pollutant Source Monitoring, Appendix A," each State must maintain an ambient monitoring program. An objective of a State system is to assess the effectiveness of the State's pollution control program. Data are generally stored in the STORET system.

Data Systems

The EPA's monitoring data are primarily stored in STORET, one of the Nation's largest computer files. The term is an acronym for STOrage and RETrieval of water quality data. The system was designed in 1962-63 by the Public Health Service to handle data from a broad variety of activities in the field of water pollution control. Today, 42 States, 10 different Federal Agencies and a variety of local groups provide data to STORET. The more important STORET statistics for FY75 follow:

Size	
Number of stations	214,802
Number of observations (8 million added in 1975)	34,400,000
Activity	
Storage jobs	15,921
Retrieval/analysis jobs	34,275
Users	240
Costs	
Computer	$1,352,000
Personnel	722,000
Other (including contracts)	285,000
Total	$2,359,000

Usage (Pertains to PL 92-500 retrievals except as noted)

	% of total use
Planning (Sections 106, 201, 208, 209, 303)	18
Permitting (Sections 402, 404)	2
Enforcement (Sections 308, 309)	3
Standards (Sections 304, 316)	2
Reporting (Sections 210, 305, 315)	17
Surveillance (Section 104)	29
Research (Sections 105, 314)	5
Control (Sections 108, 313)	5
Non-PL 92-500 uses	19

(81 percent of the retrievals were made by State and Regional users.)

In addition to STORET, EPA maintains a number of manual files. The largest is maintained for NPDES self-monitoring reports. This file is rapidly growing (60,000 reports expected to be filed in FY76) and will probably require an automated system in the near future. Other manual files are maintained for NPDES sampling inspections, toxic monitoring surveys, the National Organics Reconnaissance Survey, the Environmental Radiation Ambient Monitoring Survey, the Landfill Leachate Monitoring Survey, and miscellaneous Regional and State surveys.

A system has not yet been designed for the extensive monitoring data that will be generated by programs of the Safe Drinking Water Act.

Monitoring Costs

Monitoring costs for the EPA and the States

have not been compiled on a rigorous comprehensive basis. However, a rough indication of costs can be obtained from budget information submitted for FY75 (Table 15).

TABLE 15
MONITORING COSTS—FY1975

Organizations		*$Million*
States		27.8
Regions (does not include automatic data processing)		8.6
Permit issuance/compliance/enforcement	6.4	
Planning	0.6	
Water quality surveillance	0.4	
Management of State programs	0.2	
Other	1.0	
Headquarters		13.0
Office of Enforcement (National Field Investigation Centers)	0.7	
Office of Research and Development		
Quality assurance	4.1	
National Eutrophication Survey	1.8	
New York Bight	0.3	
Great Lakes	1.7	
Miscellaneous lake monitoring	0.4	
Office of Water Planning and Standards		
Computer support—STORET	1.5	
Managing and operating STORET	0.4	
National Water Quality Surveillance System	0.6	
Management of State monitoring	0.4	
Effluent Data System	0.2	
Water quality analysis of data and management of water quality inventories	0.2	
Office of Water Program Operations (ocean dumping)	0.7	
Total		49.4

It should be noted that this compilation does not include costs for the pesticides and radiation monitoring programs, and does not reflect costs that may be expected in the future covering programs of the Safe Drinking Water Act.

Problem Identification and Tentative Remedial Actions

The primary water monitoring problems, their contributing causes (or sub-problems), and possible remedial actions fall into six broad categories:

1. EPA has no cohesive policy that encompasses all water monitoring activities.
   - Organizational and programmatic fragmentation present difficult obstacles to unified policy.
   - Legislative fragmentation in the form of six major acts requires an array of frequently overlapping monitoring activities.
   - There is no office or group that has been given the responsibility to develop or coordinate broad policy in the area of water monitoring.

   Possible Remedial Actions
   - Establish a continuing Headquarters/Regional/State policy coordinating group. This group should address:
     - —Quality control practices.
     - —Communication and dissemination of information.
     - —Uniformity of reporting formats.
     - —A methodology to convert data into useful information.
     - —Develop a water monitoring strategy that includes setting priorities.
     - —This strategy must address short-term requirements as well as long-range planning for monitoring requirements.
     - —A major consideration in setting priorities will be using monitoring resources to their best advantage.
2. Ambient monitoring systems do not provide for ready reporting of Regional and national water quality conditions and trends.
   - Parametric coverage, sampling frequency, and station sitings are inadequate.
   - Quality control practices have been inadequate to ensure that users receive valid data.
   - There are insufficient resources as well as inappropriate resource allocations.
   - Data collection, storage, and use are fragmented.
   - A network to provide adequate information on oceans and estuaries is lacking.
   - Laboratory equipment and expertise are not used to the Agency's best advantage.

   Possible Remedial Actions
   - Design and implement a multiple-use ambient water monitoring system.
   - Develop an overall monitoring strategy.

- Expand the quality assurance program to stress sample collection and data handling procedures.
- Augment or reallocate resources.
- Make greater use of intensive surveys for estuaries and other water bodies of complex hydrology.
- Coordinate EPA, State, and USGS monitoring efforts.

3. Monitoring systems do not provide data to adequately document progress toward achieving program objectives.
   - Objectives requiring monitoring support are not specified in a number of programs.
   - Baseline data are inadequate.
   - Poor communication between collectors and users has resulted in an inadequate understanding of what data are needed.
   - Data collection and handling functions are fragmented.
   - Monitoring systems are inadequately designed.
   - Meaningful indices to measure progress are lacking.

   Possible Remedial Actions
   - Develop an overall monitoring strategy.
   - Design monitoring systems that are oriented to priority uses.
   - Develop and implement improved coordination procedures.
   - Increase and reallocate resources.
4. Monitoring systems do not provide data to adequately support development or revision of certain program elements.
   - Ambient networks do not provide adequate data for Section 208 plans, especially data on nonpoint sources.
   - Monitoring of ocean dumping and sludge disposal sites is inadequate.
   - Methods currently used for ambient monitoring of certain toxic materials may not be sensitive enough to be meaningful.
   - Ambient systems are needed to check on compliance.

   Possible Remedial Actions
   - Redesign monitoring to meet needs for specific program uses.
   - Make greater use of intensive special-purpose surveys.
   - Increase or reallocate resources.
5. Monitoring systems do not provide adequate support for certain enforcement activities.
   - NPDES self-monitoring reports are not verified.
   - NPDES self-monitoring data are not stored for ready retrieval and use.
   - Ambient systems do not provide adequate support for enforcing permit conditions based on load allocations.
   - A data system to verify self-monitoring data is lacking.

   Possible Remedial Actions
   - Redesign ambient systems, and stress intensive surveys and special studies.
   - Design and institute a "manageable" NPDES automatic data processing system.
   - Increase or reallocate resources.
6. Development of models, criteria, and standards is frequently frustrated by unavailable or inadequate data.
   - Data on background levels are inadequate.
   - Data on dose/response effects, especially for toxics, are inadequate.
   - Data for developing and verifying models are not sufficiently detailed.
   - Sampling and analyses techniques, especially for pesticides and toxics, are inadequate.
   - Collection, storage, and retrieval of data are fragmented.
   - The relationship between point and nonpoint sources is not well understood.
   - Best use of existing data and what is needed to complement it needs further study.
   - Starting in FY77, additional information will be required to develop more stringent water quality standards as outlined in the FWPCA.
   - Data are lacking for the wasteload allocation process and for writing permits.

   Possible Remedial Actions
   - Provide emphasis to biological and health effects monitoring.
   - Provide emphasis to monitoring of toxic and hazardous pollutants; de-emphasize monitoring of traditional sanitary engineering parameters.

- Make greater use of intensive surveys and special studies.
- Augument or reallocate resources.
- Develop and institute coordination procedures, especially between Office of Research and Development and program offices.

Work Group Study Efforts

Most of the problems areas identified have been caused by the lack of an overall perspective to the monitoring program. The following recommended tasks consider monitoring in its entirety. The Work Group should focus its effort on the following tasks:

1. Develop an agency-wide water monitoring strategy that would include:
   - A statement of legislative goals.
   - A statement of program objectives.
   - A statement of monitoring priorities.
   - A statement of monitoring roles and responsibilities.
   - A statement of monitoring outputs.
2. Design a cost-effective ambient monitoring network that would include the following major elements and emphases:
   - Station siting criteria should emphasize stations that provide data for problem evaluation and Regional/National trend analysis.
   - Parametric coverage should emphasize toxic pollutants and biological measures.
   - Monitoring frequencies should be based primarily on statistical confidence.
   - Data development and processing should stress quality assurance and usability.
   - Monitoring requirements should optimize use of resources—labor, equipment, shipping, and data processing.
3. Design intensive and special purpose monitoring surveys to provide ambient and other data not available from fixed station networks. Estuaries and marine locations, which currently lack information, should receive priority.
4. Design an effluent monitoring program that would include the following major elements and emphases:
   - Parametric coverage should emphasize toxic pollutants.
   - Self-monitoring frequency should vary for different dischargers, based on specific selection criteria.
   - Selections for EPA/State nonsampling inspections should be determined primarily by data processing systems.
   - Selections for EPA/State nonsampling inspections should be determined primarily by data processing systems.
   - Selections for EPA/State sampling inspections should be determined primarily by results of nonsampling inspections and manipulations of data processing systems.
   - Selected data should be stored in a "manageable" automatic data processing system.
5. Develop a drinking water monitoring system that stresses simplicity, maximum State involvement, and coverage of toxic pollutants.
6. Identify priority research and quality assurance needs.
   - Background level surveys.
   - Health and biological cause/effect relationships for toxic pollutants.
   - Laboratory and technical assistance support for sampling and analysis for toxic pollutants.
   - Quality assurance support for sampling and data preparation.
7. Develop alternative operating strategies based on detailed analysis of workloads and EPA/State resources.

WATER MONITORING QUESTIONNAIRE

NAME_____ TITLE_____

1. Indicate, in matrix provided, the priority of use in your office or division: High (H), medium (M), low (L).

2. Specify kind of data needed: Ambient (A), discharge (D), biological (B), health (H), other (O).

3. Indicate deficiencies, if any, with design of existing monitoring systems: Parametric coverage (P), station coverage (S), frequency of sampling (F), data handling (D), other (O).

4. Indicate deficiencies, if any, with data received: Completeness (C), acuracy (A), timeliness (T).

5. Indicate sources of data used: STORET (S), non-computer (N), discharge reports (D).

6. Identify primary constraints: Manpower (M), cost (C), technology (T), other (O).

7. Where problems have been indicated, please suggest changes for improvement (space at bottom of matrix may be used for suggestions, if needed).

8. Identify major problems you have with State and Regional monitoring programs.

9. Estimate the level of effort within your office/division devoted to data acquisition and/or analysis:

   man-years_____ non-labor costs (e.g., computer time) $_____

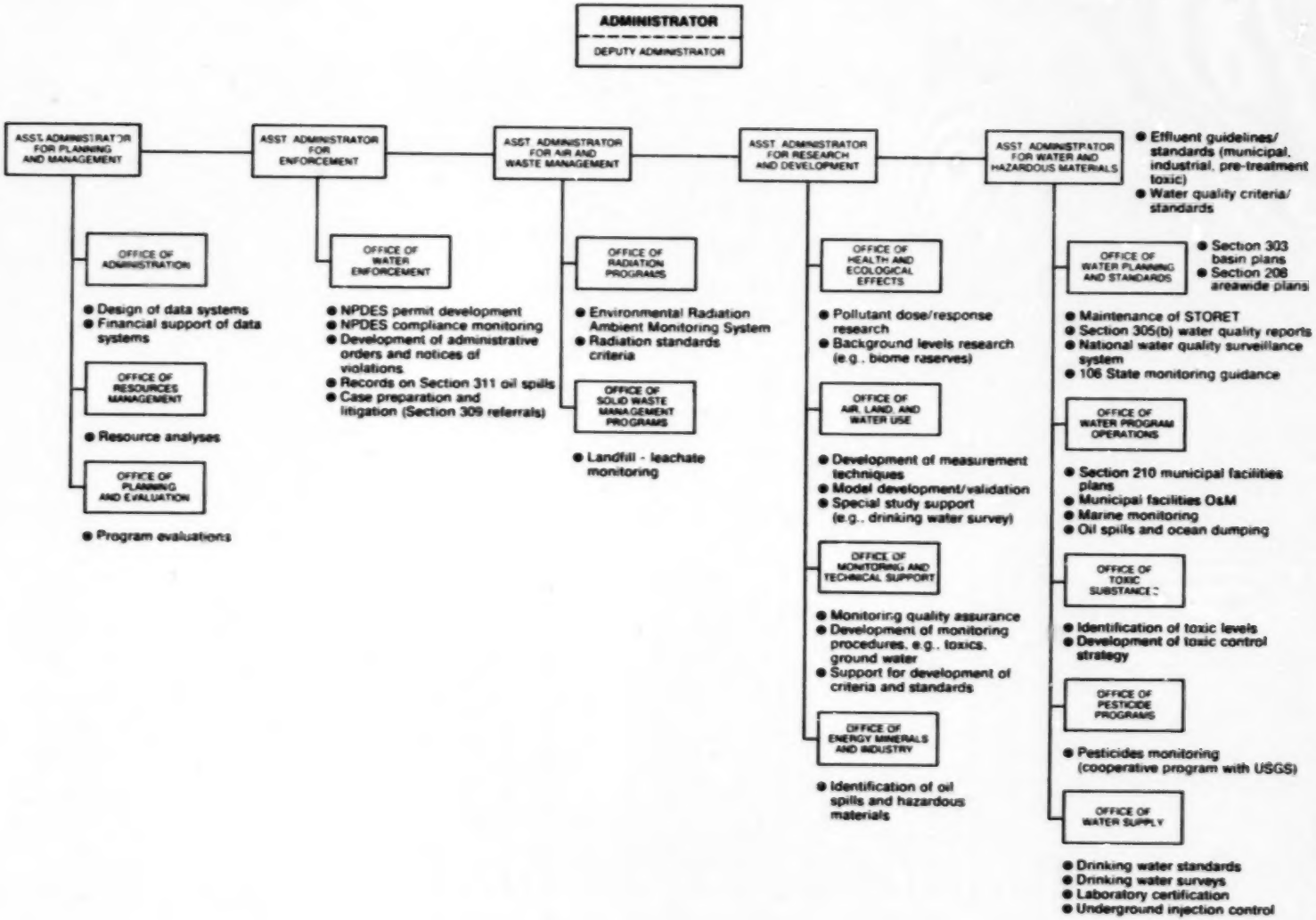
   Is this level appropriate to meet your responsibilities? Yes___ No___

10. Do you need historical data that are more than five years old? If so, for how many years?

11. Are there data which you will need in the future, but are not presently using? If so, indicate data need and use.

Monitoring Use	*Priority H/M/L*	*Kind of data A/D/B/H/O*	*Design deficiencies P/S/F/D/O*	*Data deficiencies C/A/T*	*Constraints M/C/T/O*
1. Develop/revise water quality standards.					
2. Develop/revise Section 303 basin plans.					
3. Develop/revise Section 208 areawide plans.					
4. Develop/revise Section 201 facilities plans.					
5. Document progress toward achievement/ maintenance of ambient standards and legislative goals.					
6. Monitor primitive areas for background levels and significant deterioration.					
7. Development of baseline information.					
8. Model validation/development.					
9. Health research/control techniques development.					
10. EIS development/evaluation.					
11. Development/revision of effluent standards.					
12. Formulate/revise discharge permits.					
13. Permit compliance.					
14. Develop/revise drinking water standards.					
15. Develop/revise pesticides monitoring plan.					
16. Develop/revise toxic standards.					
17. Develop/revise pre-treatment standards.					
18. Single pollution incidents (fish kills, oil spills).					
19. Develop/assess/revise point source control strategies.					
20. Develop/assess/revise nonpoint source control strategies.					
21. Resource allocations.					
22. Public reporting (indices, trends, etc.)					
23. Support of enforcement actions.					
24. Other.					

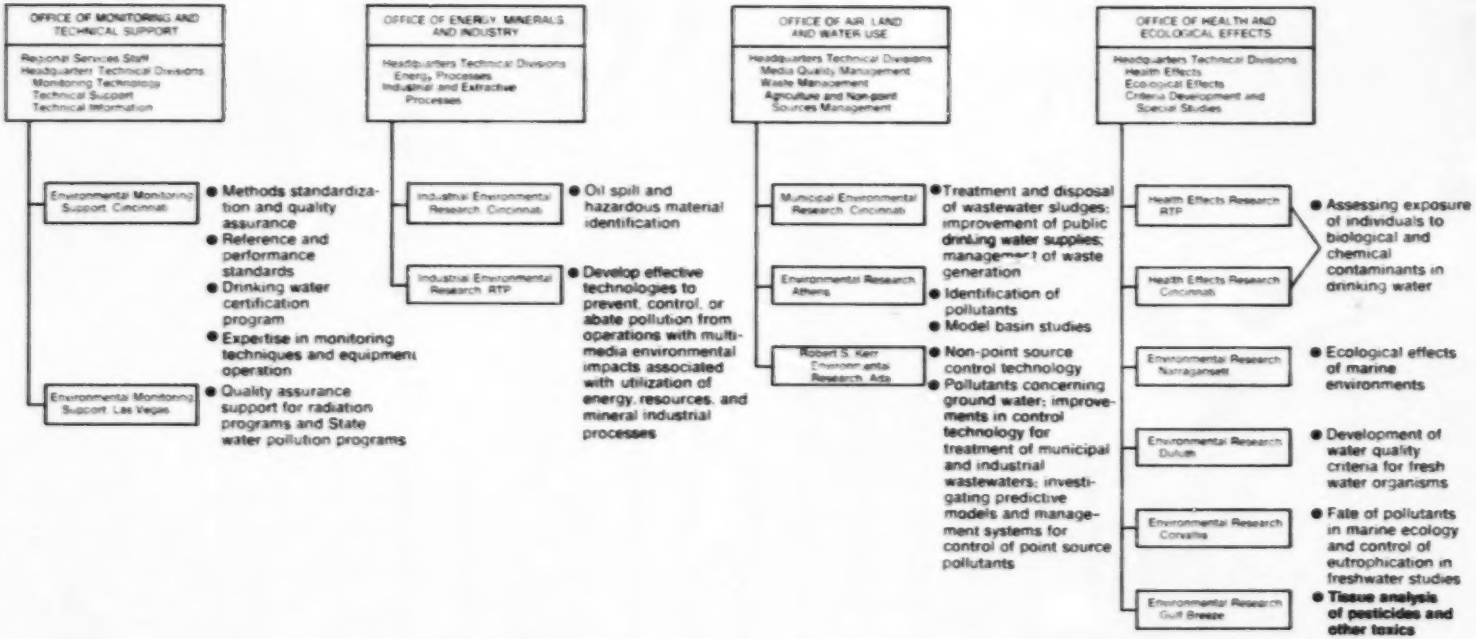
U.S. Environmental Protection Agency – Water Monitoring Activities


ADMINISTRATOR
DEPUTY ADMINISTRATOR
ASST. ADMINISTRATOR FOR PLANNING AND MANAGEMENT
ASST. ADMINISTRATOR FOR ENFORCEMENT
ASST. ADMINISTRATOR FOR AIR AND WASTE MANAGEMENT
ASST. ADMINISTRATOR FOR RESEARCH AND DEVELOPMENT
ASST. ADMINISTRATOR FOR WATER AND HAZARDOUS MATERIALS
OFFICE OF ADMINISTRATION
● Design of data systems
● Financial support of data systems
OFFICE OF RESOURCES MANAGEMENT
● Resource analyses
OFFICE OF PLANNING AND EVALUATION
● Program evaluations
OFFICE OF WATER ENFORCEMENT
● NPDES permit development
● NPDES compliance monitoring
● Development of administrative orders and notices of violations
● Records on Section 311 oil spills
● Case preparation and litigation (Section 309 referrals)
OFFICE OF RADIATION PROGRAMS
● Environmental Radiation Ambient Monitoring System
● Radiation standards criteria
OFFICE OF SOLID WASTE MANAGEMENT PROGRAMS
● Landfill - leachate monitoring
OFFICE OF HEALTH AND ECOLOGICAL EFFECTS
● Pollutant dose/response research
● Background levels research (e.g., biome reserves)
OFFICE OF AIR, LAND, AND WATER USE
● Development of measurement techniques
● Model development/validation
● Special study support (e.g., drinking water survey)
OFFICE OF MONITORING AND TECHNICAL SUPPORT
● Monitoring quality assurance
● Development of monitoring procedures, e.g., toxics, ground water
● Support for development of criteria and standards
OFFICE OF ENERGY MINERALS AND INDUSTRY
● Identification of oil spills and hazardous materials
● Effluent guidelines/standards (municipal, industrial, pre-treatment toxic)
● Water quality criteria/standards
OFFICE OF WATER PLANNING AND STANDARDS
● Section 303 basin plans
● Section 208 areawide plans
● Maintenance of STORET
● Section 305(b) water quality reports
● National water quality surveillance system
● 106 State monitoring guidance
OFFICE OF WATER PROGRAM OPERATIONS
● Section 210 municipal facilities plans
● Municipal facilities O&M
● Marine monitoring
● Oil spills and ocean dumping
OFFICE OF TOXIC SUBSTANCES
● Identification of toxic levels
● Development of toxic control strategy
OFFICE OF PESTICIDE PROGRAMS
● Pesticides monitoring (cooperative program with USGS)
OFFICE OF WATER SUPPLY
● Drinking water standards
● Drinking water surveys
● Laboratory certification
● Underground injection control

REGIONAL WATER MONITORING ACTIVITIES

- NPDES compliance monitoring.
- Section 303 basin plans.
- Section 208 areawide planning.
- STORET input and use.
- Section 305(b) water quality reports.
- Section 201 municipal facilities plans.
- Ocean dumping (Regulations II and III).
- Administration of Section 106 State monitoring requirements.
- Quality assurance activities:
  - —Laboratory evaluations;
  - —Certification of drinking water laboratories; and,
  - —Assistance of State and local agencies concerning techniques, methodology, quality control, and laboratory support.
- Gathering of pesticide samples.
- Emergency and spill response—oil and hazardous materials.

Water Monitoring Laboratory Support


OFFICE OF MONITORING AND TECHNICAL SUPPORT
Regional Services Staff
Headquarters Technical Divisions
Monitoring Technology
Technical Support
Technical Information
Environmental Monitoring Support Cincinnati
● Methods standardization and quality assurance
● Reference and performance standards
● Drinking water certification program
● Expertise in monitoring techniques and equipment operation
Environmental Monitoring Support Las Vegas
● Quality assurance support for radiation programs and State water pollution programs
OFFICE OF ENERGY, MINERALS AND INDUSTRY
Headquarters Technical Divisions
Energy Processes
Industrial and Extractive Processes
Industrial Environmental Research Cincinnati
● Oil spill and hazardous material identification
Industrial Environmental Research RTP
● Develop effective technologies to prevent, control, or abate pollution from operations with multi-media environmental impacts associated with utilization of energy, resources, and mineral industrial processes
OFFICE OF AIR, LAND AND WATER USE
Headquarters Technical Divisions
Media Quality Management
Waste Management
Agriculture and Non-point Sources Management
Municipal Environmental Research Cincinnati
● Treatment and disposal of wastewater sludges; improvement of public drinking water supplies; management of waste generation
Environmental Research Athens
● Identification of pollutants
● Model basin studies
Robert S. Kerr Environmental Research Ada
● Non-point source control technology
● Pollutants concerning ground water; improvements in control technology for treatment of municipal and industrial wastewaters; investigating predictive models and management systems for control of point source pollutants
OFFICE OF HEALTH AND ECOLOGICAL EFFECTS
Headquarters Technical Divisions
Health Effects
Ecological Effects
Criteria Development and Special Studies
Health Effects Research RTP
Health Effects Research Cincinnati
● Assessing exposure of individuals to biological and chemical contaminants in drinking water
Environmental Research Narragansett
● Ecological effects of marine environments
Environmental Research Duluth
● Development of water quality criteria for fresh water organisms
Environmental Research Corvallis
● Fate of pollutants in marine ecology and control of eutrophication in freshwater studies
Environmental Research Gulf Breeze
● Tissue analysis of pesticides and other toxics

PRIORITIES ASSIGNED MONITORING USES BY EPA HEADQUARTERS OFFICIALS[1]

	Total	AA's (4)	DAA's (5)	PM (2)	EN (2)	WHM (6)	R&D (2)
To document progress toward achievement or maintenance of water quality standards and legislative goals.	2.5	2.5	2.4	2.3	1.6	2.5	2.1
• Monitor primitive areas for background levels and significant deterioration	1.8			2	1	1.5	3.0
• Allocate resources	2.5			3	3	2.6	
• Develop baseline information.	2.4			1	1	2.9	2.2
To provide support for public reporting of trends, indices, etc.	2.1	2.3	2.2	3	1.5	2.6	1.0
To test compliance with, and monitor enforcement of regulations limiting discharge volume and pollutant concentrations.	2.4	2.5	2.8	1.4	2.4	2.0	2.4
• Formulate/revise discharge permits	1.8			1.0	3	1.3	1.0
• Determine permit compliance	2.0			1.0	3	1.5	2.0
• Investigate single pollution incidents (fish kills, oil spills); and	2.0			1.0	1.5	2.0	3.0
• Support enforcement actions.	2.1			1.0	3.0	1.6	2.0
To provide supporting data for the development/revision of plans and standards.	2.4	2.3	2.4				
• Develop/revise water quality standards	2.0			1.0	1.5	2.2	3.0
• Develop/revise Section 303 basin plans	1.3			1.0	1.5	2.2	3.0
• Develop/revise Section 208 areawide plans	1.4			1.0	1.5	1.5	1.0
• Develop/revise Section 201 facilities plans	1.1			1.0	1.5	1.0	1.0
• Develop/revise drinking water standards	1.7			1.0	1.0	2.0	1.0
• Develop/revise pesticides monitoring plan	1.6			1.0	1.0	1.8	3.0
• Develop/revise toxic standards	2.6			1.0	3.0	2.6	3.0
• Develop/revise pre-treatment standards	2.6			1.0	3.0	2.5	3.0
• Model validation/development.	2.2			1.0	2.5	2.0	3.0
To acquire a data base for the correlation of pollutant levels with effects on human health, plants, animals, and for future epidemiological and morbidity analyses.	2.0	2.5	2.4	1.0	1.5	2.0	2.2
To provide for development, assessment, and revision of pollution control programs and strategies.	2.2	2.0	2.4				
• Develop/assess/revise point source control strategies	2.6			3	2	2.6	2.2
• Develop/assess/revise nonpoint source control strategies.	2.0			3	1.5	2.2	1.5

[1] Priorities computed by assigning numerical values: Low priority, 1; medium priority, 2; high priority, 3. (Parentheses show number of officials).

TYPES OF MONITORING DATA NEEDED FOR EPA USES

	Headquarters Officials Needing Data [1]				
	Ambient	Biological	Effluent	Health	Other
Develop/revise water quality standards.	8	5	2	2	
Develop/revise Section 303 basin plans.	4	3	5	1	
Develop/revise Section 208 areawide plans.	5	4	6	2	
Develop/revise Section 201 facilities plans.	3	1	5	1	
Document progress toward achievement/maintenance of ambient standards and legislative goals.	11	9	7	6	2
Monitor primitive areas for background levels and significant deterioration.	11	9	4	3	3
Development of baseline information.	10	8	8	4	3
Model validation/development.	5	4	5	1	2
Develop health research/control techniques.	5	4	3	3	
Develop/evaluate environmental impact statements.	4	3	5	1	2
Develop/revise effluent standards.	3	2	7	2	
Formulate/revise discharge permits.	3	2	5	2	1
Determine permit compliance.	2	1	4	2	1
Develop/revise drinking water standards.	4	3	1	4	
Develop/revise pesticides monitoring plan.	3	2	2	2	
Develop/revise toxic standards.	5	4	5	5	1
Develop/revise pretreatment standards.	7	4	6	3	1
Investigate single pollution incidents (fish kills, oil spills).	5	6	6	3	3
Develop/assess/revise point source control strategies.	8	5	8	3	3
Develop/assess/revise nonpoint source control strategies.	7	5	7	3	4
Allocate resources.	5	3	5	2	3
Report indices, trends, etc., to the public.	5	5	5	6	4
Support enforcement actions.	3	3	4	3	2
Total	126	95	115	64	35
% of grand total	29	22	26	15	8

[1] 23 officials canvassed.

Appendix F
Sample Intensive Survey
Abstract Outline

I. INTRODUCTION

II. SUMMARY

III. DESCRIPTION OF SURVEY AREA

- A. Water Quality Problems
- B. Waste Sources in the Survey Area

IV. PRESENTATION OF SURVEY RESULTS

• U.S. GOVERNMENT PRINTING OFFICE 1980 -311-132/63